

Final Report

LIMITED ENERGY STUDY, POWER DISTRIBUTION

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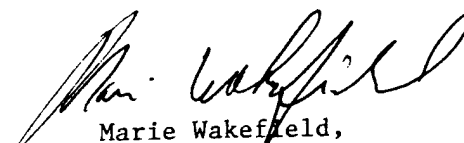

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LIST OF ABBREVIATIONS

A	- ampere
ACSR	- aluminum conductor steel reinforced
ANSI	- American National Standards Institute
ASCE	- American Society of Civil Engineers
ASME	- American Society of Mechanical Engineers
AWG	- American Wire Gauge
BIL	- basic insulation level
CNW	- condenser water
CNWP	- condenser water pump
CNWR	- condenser water return
CNWS	- condenser water supply
COE	- Corps of Engineers
CRTA	- Cold Regions Test Activity
CT	- current transformer
Δ	- (Delta) Greek letter notation for electrical equipment connected in a "delta" configuration
ECIP	- Energy Conservation Investment Program
ECO	- Energy Conservation Opportunity
EMC	- E M C Engineers, Inc.
EPR	- Ethylene Propylene Rubber
EPRI	- Electric Power Research Institute
F	- Fahrenheit
FEMP	- Federal Energy Management Program
ft	- foot, feet
gal	- gallons
GL	- ground line
gpm	- gallons per minute
hp	- horsepower
hr	- hour
IEEE	- Institute of Electrical and Electronic Engineers
IL	- in-line
kA	- one thousand ampere
kV	- one thousand volts
kW	- kilowatt, one thousand watts
kWh	- kilowatt-hours, one thousand watt-hours
LCCA	- life cycle cost analysis
LF	- load factor
lb/hr	- pounds per hour
MCACES	- Mechanical Cost Accounting Computer Estimating System
MW	- megawatt, one-thousand kilowatts
NBS	- National Bureau of Standards
NEC	- National Electric Code
NESC	- National Electrical Safety Code
NIST	- National Institute of Standards and Technology

OA/FA	- liquid-immersed, self-cooled/forced-air-cooled
OH	- overhead
O&M	- operation and maintenance
P	- perpendicular
PF	- power factor
ϕ	- (Phi) Greek letter notation for "phase"
ϕ -N	- shorthand notation for a phase-to-neutral wire connection
ϕ - ϕ	- shorthand notation for a phase-to-phase wire connection
psia	- pounds per square inch absolute
psig	- pounds per square inch gage
rpm	- revolutions per minute
sec	- second
SIR	- Savings-to-Investment Ratio
SOW	- scope of work
sq ft	- square foot
temp.	- temperature
UG	- underground
V	- volt(s)
VAR	- volts-ampere reactive
XLPE	- Cross-Linked Polyethylene
Y	- short hand notation for electrical equipment connected in an "ungrounded wye" configuration
YGRD	- short hand notation for electrical equipment connected in a "grounded wye" configuration
yr	- year(s)

at this site. At the very least, ground fault detection should be implemented as determined in previous studies.

1. INTRODUCTION

1.1 AUTHORITY FOR STUDY

This study was performed and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 003. The Delivery Order was issued by U.S. Army Engineer District, Mobile, to E M C Engineers, Inc. on 28 September 1994.

1.2 PURPOSE OF STUDY

The purpose of this study is to evaluate the Energy Conservation Opportunity (ECO) associated with converting the existing Ft. Greely power distribution system from a 2400 volt, 3-wire, ungrounded delta distribution system to a 4160 volt, 4-wire, grounded wye distribution system.

1.3 SCOPE OF WORK

The Scope of Work (SOW) for this energy study is included in Appendix A of this report. The following services are required by the SOW:

- Perform a limited site survey of the overhead and underground distribution system, the central plant, and other facilities was performed to determine the parameters of the existing system and evaluate its physical condition. The evaluation of the systems physical condition includes insulators, crossarms, poles, wires, connectors and transformers.
- Perform computer modeling of the distribution system to determine the system losses associated with operating at 2400 volts and 4160 volts for both the pre-realignment (before 1997) and post-realignment (after 2001) scenarios.
- Determine the construction costs associated with converting the distribution system from a 2400 volt, 3-wire, ungrounded delta to a 4160 volt, 4-wire, grounded wye.
- Determine the cost of providing electrical service to post-realignment buildings directly from the Golden Valley Electric Association (GVEA) distribution system. [EMC was instructed not to address this issue.]
- Perform life cycle cost analysis (LCCA) according to Energy Conservation Investment Program (ECIP) and Federal Energy Management Program (FEMP) criteria.

- Provide a comprehensive report presenting field survey data, methods of analysis and recommendations of the study.
- Prepare ECIP/FEMP programming documentation for ECOs which meet government funding criteria.

1.4 DEMAND AND ENERGY COSTS

The demand and energy costs for electricity delivered to Fort Greely from GVEA and Fort Wainwright were taken from data provided by Fort Wainwright personnel. Approximately 83% of the electric energy used at Fort Greely is derived from Fort Wainwright generators and wheeled over GVEA distribution lines for the cost of wheeling. The remaining 17% is purchased directly from GVEA at a cost based on their GS-2 rate schedule. Demand charges are based on the peak kW used per month, regardless of whether it is wheeled or purchased power. In order to simplify the analysis for this study, the energy costs were evaluated over the one year period starting on the first day of September 1993 and ending on the last day of August 1994. The energy costs from the two different suppliers, Fort Wainwright and GVEA, were weighed based upon the percentage used from each source at Fort Greely and summed to obtain an average energy cost. The demand charge remains the same in either case. The electric rates used in this study are as follows:

- Electric demand charge: \$6.25/kW/month
- Electric energy charge: \$0.0711 per kWh

If the demand charge is incorporated into the energy charge to further simplify the calculations, the electric energy charge will be \$0.832 per kWh.

1.5 CONSTRUCTION COST ESTIMATING

ECO construction costs were taken primarily from the MCACES construction cost estimating database for Fairbanks (1994). When the cost information in this database was inadequate, vendor quotes or the 1995 Means Electrical Cost Data were used. An additional 20% location factor was added to all costs that were not taken from the MCACES database to account for added shipping expenses and other charges associated with Fort Greely's remote location and/or extreme weather. Additional markups used for the LCCA include:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.

- 4% for escalation.
- 5% for SIOH.
- 6% for design costs.

1.6 LIFE CYCLE COST ANALYSIS METHODOLOGY

The Life Cycle Cost Analysis (LCCA) methodology used in this study is a Present Worth analysis. It compares the present worth of the energy cost savings associated with the distribution system improvements over a 20 year period (reflected back into the first year of the period) with the construction cost or investment necessary to implement the distribution system improvements in the first year of the period. The Savings-to-Investment Ratio (SIR) must be greater than 1.25 in order to qualify under the ECIP Program. Thus, the energy cost savings over a 20 year period must be 25% greater than the investment required in the first year. Operation and maintenance (O&M) costs were neglected because there is no significant difference in O&M between 2400 volts and 4160 volts.

Economic analyses were performed in accordance with the January 1994 ECIP guide. Uniform Present Value (UPV) factors are based on a 4.1 percent DOE discount rate (for FEMP projects). The UPV factors were taken from Table A-2 and Ba-4 of the NISTIR 85-3273-10 (Rev. 10/95), Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996, (the current annual supplement to the NIST Handbook 135 and NBS Special Publication 709). The economic and service life of equipment was taken from Appendix B of the ECIP guide. Copies of all the appropriate LCCA factors are found in Appendix J.

The following UPV factors, adjusted for average fuel price escalation, were taken from the NIST 135 Supplement for Industrial Customers.

Life (Years)	Electricity	Natural Gas	Non-Energy
20	14.47	17.32	13.47

1.7 ORGANIZATION OF DOCUMENT

This report is organized as follows:

- Section 2 describes the existing electrical distribution system and the field tests performed to evaluate its physical condition.
- Section 3 discusses in detail the system model and load flow analysis used to determine the system losses for the existing electrical distribution system.

- Section 4 describes the electrical distribution system after realignment has reduced the number of facilities served.
- Section 5 discusses in detail the system model and load flow analysis used to determine the system losses for the reduced electrical distribution system.
- Section 6 summarizes the results of Sections 2 through 5 and recommends a course of action.

2. EXISTING SYSTEM DESCRIPTION AND EVALUATION (1995 TO 1997)

2.1 GENERAL

The existing electric distribution system at Ft. Greely is operated as a 2400 volt (V), 3-phase (ϕ), ungrounded, delta (Δ) system on all feeders except one. Feeder 9 is more than three times the length of the other eight feeders combined, and is operated as a 7200 V, 3 ϕ , ungrounded, Δ system. It feeds the remote facility at Bolio Lake and all of the Ranges.

2.2 DETAILS

Major features of each electric distribution system are described in detail below.

2.2.1 Buildings

There are currently 231 buildings that receive electric power from the Fort Greely electric distribution system. The buildings total 1,699,787 sq ft consisting of schools, offices, housing units, aircraft hangars, fuel stations, construction shops, water and waste treatment facilities, and a power and heating plant. The majority of buildings are located in the cantonment area and the rest are located at the Cold Regions Test Activity (CRTA) at Bolio Lake, and at the Ranges (Arkansas, Beales, Colorado, Georgia, Lampkin, Mississippi, Tennessee and Texas). Generally, the building loads are of high power factor (approximately 95%) and high load factor (approximately 80%). Approximately 81% of the building loads are 3 ϕ , the primary building utilization voltage is 120/208 V, 3 ϕ , grounded wye.

2.2.2 Transformers

The buildings are supplied by a total of 298 transformers from the Fort Greely electric distribution system. Only 288 transformers actually supply building loads, six are step-up substation transformers on Feeder No 9, and four are station service transformers for Building 606, the Power & Heating Plant. The step-up substation transformers are arranged into two 3 ϕ , banks. The following describes these transformers in more detail.

2.2.2.1 Main Transformer (GVEA)

The main transformer supplies the base from the GVEA distribution system. It is a 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV, YGRD- Δ substation class transformer with top mounted primary and secondary bushings. This transformer is located adjacent to Building 606 and is owned and maintained by GVEA. It is not included as part of the 298 transformers described above.

This transformer will need to be replaced if the Fort Greely electric distribution system is upgraded to 4.16 kV. It will be necessary to coordinate with GVEA on the exact winding configuration.

2.2.2.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 substation consists of three 1 ϕ , 500 kVA, OA, 2.4/4.16 - 7.2/12.47 kV pole-mounting type transformers, connected Δ - Δ , with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad adjacent to Building 606.

These transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused if the system voltage is increased to 4.16 kV. This will increase the Feeder 9 voltage from 7200 V to 12,470 V.

2.2.2.3 Richardson Step-Up Substation Transformer

The Richardson substation consists of three 1 ϕ , 200 kVA, OA, 2.4 - 7.2 kV pole-mounting type transformers, connected Δ - Δ , with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad near the Richardson Highway in the West Post area.

The nameplate on the transformers does not specifically indicate that the transformers are rated for operation at 4.16 kV and 12.47 kV. However, EMC believes that these transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary, and reused at 4.16 kV and 12.47 kV, respectively. The winding voltage and insulator bushing ratings will not change and the phase-to-phase clearance is adequate. It will be necessary to rewire these transformers to match the Feeder 9 step-up transformer voltage.

2.2.2.4 Building 606 Station Service Transformers

Building 606 is supplied by four station service transformers: SS-1, SS-2, and two SM1As. Transformer SS-1 is a 300 kVA dry type transformer. Transformer SS-2 is a 300 kVA pad mounted transformer. Both SM1A transformers are 500 kVA dry type transformers. All

four transformers are 3 ϕ , 2400-480 V, Δ - Δ . They will all need to be replaced if the system voltage is upgraded to 4.16 kV, because they cannot be rewired.

2.2.2.5 Load Transformers

Five of the 288 load supplying transformers are 3 ϕ pad-mounted transformers, 207 are connected into sixty-nine 3 ϕ transformer banks, and the remaining 76 are 1 ϕ transformer banks. The transformer voltages, connections, and quantities are shown in Table 2-1 below.

Table 2-1. Load Transformer Connections

ϕ	Voltage				Mount Type	No. of Banks	Trans./ Bank	No. of Trans.
	Primary	Conn.	Secondary	Conn.				
3	2400	Δ	120/208	YGRD	Pole	50	3	150
3	2400	Δ	277/480	YGRD	Pole	6	3	18
3	7200	Δ	120/208	YGRD	Pole	13	3	39
3	2400	Δ	120/208	YGRD	Pad	3	1	3
3	7200	Δ	120/208	YGRD	Pad	2	1	2
1	2400	ϕ - ϕ	120/240	Ctr. Tap	Pole	56	1	56
1	7200	ϕ - ϕ	120/240	Ctr. Tap	Pole	20	1	20
Totals						150		288

All of the pad-mounted transformers will need to be replaced if the distribution system voltage is increased to 4.16 kV and 12.47 kV. The 3 ϕ , pole-mounted transformer primaries can be rewired to a grounded wye configuration and reused. The 1 ϕ , pole mounted transformers can be rewired from ϕ - ϕ to ϕ -N and reused. The winding voltage and insulator bushing ratings will not change.

2.2.3 Feeders

The load transformers are supplied by nine feeders comprised of 31.2 miles of overhead (OH) lines and 10.7 miles of underground (UG) lines. The electric distribution system is operated as an ungrounded delta at 2400 volts, 3 ϕ . Table 2-2 below shows the feeder characteristics.

Table 2-2. Feeder Description

Feeder No.	Length & Size				Voltage L-L	Connected kVA	
	OH (ft)	AWG	UG (ft)	AWG		3 ϕ	1 ϕ
1	6250	4/0	0	-	2400	645	580
2	1750	4/0	0	-	2400	1320	0
3	3000	4/0	0	-	2400	1035.5	45
4	1700	4/0	0	-	2400	1637.5	0
5	16950	4/0	2400	2	2400	1815	115
6	0	Bus	0	-	2400	0	0
7	9450	4/0	0	-	2400	1357.5	212.5
8	4000	4/0	2000	4/0	2400	15	992.5
9	122060	2	52,096	2	7200	1557.5	260.5
Totals	165,160		56,496			9383	2205.5

Approximately 81% of the connected load for the base is three phase. Line maintenance personnel indicated that the single phase loads are well balanced between phases. In general, the feeders supply the following loads and locations:

- Feeder No. 1 - Housing in the main base area.
- Feeder No. 2 - Offices and shops in the main base area.
- Feeder No. 3 - Offices and shops in the main base area.
- Feeder No. 4 - Offices and shops in the main base area.
- Feeder No. 5 - Old and middle post areas; Allen Air Field.
- Feeder No. 6 - Overhead tie.
- Feeder No. 7 - Sewage plant and east base area.
- Feeder No. 8 - Housing in the main base area.
- Feeder No. 9 - Remote sites; Bolio Lakes and the Ranges.

2.2.3.1 Overhead Feeder Construction

Approximately 74% of the electric distribution system, by feeder length, is overhead construction. The original overhead electric distribution system was constructed between 1948 and 1957. The oldest part of the system consists of the old post and middle post at the north end of the base near Allen Air Field. The next oldest line construction was done in the mid-1970s, and the newest line construction was done in the mid-1980s.

The overhead electric distribution system is almost exclusively wooden poles and crossarms. The poles are all 40 to 50 ft in height, Class 2 or 3, and spaced at 100 to 150-ft intervals. The majority of poles are cedar, although some Douglas Fir are used. The treatment method varies from pentachlorophenol (reddish color), to chromated copper arsenate or CCA (greenish color), to creosote oil. Most poles are fully treated, however, some of the older poles are butt treated only. Eight-foot crossarms are standard although

some narrow profile Epoxirods™ have recently been installed. The Epoxirods™ comprise a very small percentage of the crossarms in use, however.

Generally, the lines are mounted on pin insulators on an 8-ft crossarm, in a flat, parallel configuration. Two lines are located on one side of the pole and one line is located on the other side. Ridge pins are typically not used, except on some of the Epoxirod™ installations. There is space available on the crossarms to install a new neutral conductor if the distribution system is converted to a grounded wye. Where the crossarms have been modified from typical construction or Epoxirods™ are used, a new neutral can be installed approximately 40 inches below the crossarm on the pole.

The majority of the base load is supplied by the overhead electric distribution system. The feeders in the high density load areas of the cantonment are #4/0 AWG, ACSR. Conductors in all other areas are #2 AWG, ACSR. Line maintenance personnel have standardized on these two conductor sizes as well as ACSR for overhead lines, although some #2 AWG CU and # 4AWG CU lines still exist in older parts of the system. None of the phase conductors will have to be replaced if the system voltage is upgraded to 4.16 kV and 12.47 kV. The load current will actually be decreased at the higher voltages.

The majority of the 2.4 kV pin insulators have been replaced with 15 kV class insulators over the past ten years. Approximately 15% of these will need have to be replaced. Refer to the Field Investigations below for further discussion on the pin insulators.

2.2.3.2 Underground Feeder Construction

The remaining 26% of the electric distribution system is underground construction. Most of the underground electric distribution system was installed in the mid-1980s using 15 kV, shielded, EPR insulated cable. It was assumed that the insulation level is 133% minimum, since the system is ungrounded with no ground fault indication. Additionally, most of the underground cable was direct buried. In some cases, such as the underground feeder to "the Condos", it was not buried deep enough to avoid the effect of frost heave. In those cases, the cable has been heaved to the surface and damaged resulting in cable splices in several places.

Line maintenance personnel have standardized on 15 kV, shielded, EPR insulation for underground distribution lines and risers, however, some 15 kV, XLPE insulated cable still exists in older parts of the base.

It is not necessary to replace the feeders or add an additional wire for a neutral if the system voltage is upgraded to 4.16 kV and 12.47 kV. All three-phase feeders supply balanced three-phase loads. No single-phase loads were supplied by underground feeders.

2.2.4 Generators

There are five diesel engine generators located in Building 606. Generators 1, 2, and 3 are alike and generators 4 and 5 are alike. Table 2-3 below summarizes the generators characteristics.

Table 2-3. Characteristics of Engine Generators

Gen. No.	Rated kVA	PF	Rated kW	rpm	ϕ	Voltage	Mfr.	Ser. No.	Output Connect.
1	1250	0.8	1000	360	3	2400	Elliott Co.	3-S-9691	Y
2	1250	0.8	1000	360	3	2400	Elliott Co.	2-S-9691	Y
3	1250	0.8	1000	360	3	2400	Elliott Co.	1-S-9691	Y
4	1563	0.8	1250	360	3	2400/4160	Elliott Co.	4-S-10915	Δ
5	1563	0.8	1250	360	3	2400/4160	Elliott Co.	7-S-10915	Δ

The generators are usually operated as peak shavers to reduce the load on the GVEA main transformer. The base load can reach 3450 kW and the GVEA transformer is rated at 2500/3125, liquid-immersed, self-cooled/forced-air cooled (OA/FA). Based on the recorded data from July 1, 1994 through July 31, 1995, the generators are usually operated at approximately 1000 kW when the base load reaches 3400 kW.

All of the generators are 6-lead machines. Generators 1, 2, and 3 are connected in an ungrounded Y configuration, meaning that the T1, T2, and T3 leads are connected to phases A, B, and C respectively, and the T4, T5, and T6 leads are tied together at a common neutral bus not bonded to ground. This indicates that the windings are only rated for 1386 V and means that if these generators are to be used on a 4160 V, grounded wye system, they will require a 2.4 - 4.16 kV, Δ -YGRD step-up transformer.

Generators 4 and 5, on the other hand, are connected in a delta configuration, meaning that the T1 and T3 leads are tied together, the T2 and T4 leads are tied together, and the T3 and T5 leads are tied together. This indicates that the windings are rated for 2400 V and means that these generators can be used on a 4160 V, grounded wye system by reconnecting the leads from a delta configuration to a grounded wye configuration.

2.2.5 Medium Voltage Switchgear

The main switchgear at Building 606 is from two different manufacturers. The gray switchgear, north and south was manufactured by General Electric Company (GE). It is rated for 1200 A and 4.16 kV (4.76 kV maximum). The circuit breakers are GE Magna-blast™ type. The following data was taken from the nameplate of one breaker:

50 MVA - Interrupting Rating

7,000 A - Interrupting Rating @ Rated Voltage (4160 V)
12,500 A - Maximum Interrupting Rating
20,000 A - Momentary Rating
8 Cycles - Interrupting Time

The orange switchgear (commercial tie with GVEA) was manufactured by Westinghouse Electric Company (Westinghouse). It is rated for 1200 A and 4.16 kV (4.76 kV maximum). No interrupting ratings were listed on the equipment, and no documentation was found that confirmed its ratings. The breakers, however, were Westinghouse De-Ion™ type of the same approximate generation as the GE Magna-blast™ breakers. It was assumed for the purpose of this study that the interrupting and momentary ratings of the Westinghouse De-Ion™ breakers are the same as the GE Magna-blast™ breakers.

Table 2-4 below shows the fault levels available at the GE and Westinghouse busses based on the results of previous fault studies.

Table 2-4. Short Circuit Levels Available

Bus	Utility & 5 Generators (kA/MVA)	Utility Only (kA/MVA)	5 Generators Only (kA/MVA)	4 Generators Only (kA/MVA)
General Electric	14.3/60	5.3/22	10.1/42	7.9/33
Westinghouse	14.3/60	5.3/22	10.0/41.5	7.9.33

When the five base generators and the utility are on-line simultaneously (represented by the shaded area in the table above), the first half cycle fault levels available exceed the interrupting rating of the breakers. Two factors mitigate these findings, however. First, the breakers have an 8 cycle interrupting time, which means that by the time the breaker actually interrupts the fault, 4 to 8 cycles after its inception, the fault level has actually decreased significantly. Second, the occurrence of all five base generators and the utility operating simultaneously is rare. It is expected that the simultaneous operation of the all five generators and the utility would only occur for a short period of time in anticipation of a utility outage.

It will not be necessary to replace any of the switchgear if the system voltage is upgraded to 4.16 kV. The existing switchgear is rated for 4.16 kV and the bus ampacities will be more than adequate, since the load current will be reduced to 58% of its present value at the higher voltage. Additionally, the available fault currents will decrease with the increased voltage.

2.2.6 Miscellaneous Equipment

2.2.6.1 Richardson Step-Up Substation Breaker

The oil circuit breaker at this location is an Allis Chalmers Type OX-18 (Serial No. 305756). It is rated for 600 A continuous current, 7.2 kV and 75 kV BIL. It was manufactured in December 1955, and is only rated for 7.2 kV phase-to-phase. It will need to be replaced with a 15 kV phase-to-phase rated switch.

2.2.6.2 Load Break Air Switches

These sectionalizer switches are relatively new additions to the overhead distribution system and are A B Chance, Type D, Catalogue No. CD7HE1CL. They are rated for 600 A continuous current, 40 kA momentary current, 15 kV, and 110 kV BIL. These switches will not have to be replaced if the system voltage is increased to 4.16 and 12.47 kV.

2.2.6.3 Cutout Switches

Each load transformer is protected by an XS Style cutout switch. The rating of the cutouts is not known, however, they have only been available in a 15 kV rating for many years. In addition, a 200 A continuous current rating is commonly used on overhead distribution systems, especially in conjunction with 4/0 ACSR. Therefore, it is assumed that the cutouts are rated at 200 A continuous current, 15 kV, and 110 kV BIL, the standard rating available from most manufacturers. While the cutouts will not have to be replaced, their fuses will all have to be replaced if the voltage is upgraded to 4.16 kV and 12.47 kV. The National Electrical Code (NEC, Table 450-3(a)(1)) requires that the continuous current rating of the primary protection for a transformer not exceed 300% of the rated continuous primary current of the transformer. Since the primary current of the transformer will be reduced to 58% of its original value because of the voltage increase, all of the fuses will be too large.

2.2.6.4 Protective Relays

A Protective Device Coordination Study was recently performed and the protective devices reset to the recommended values. If the system voltage is increased, the load and fault current levels will all change. This will require that any current sensing type protective device be reset in order to maintain coordinated tripping and to ensure proper protection. Table 2-5 below shows the devices with current sensitive tripping that will need to be reset.

Table 2-5. Protective Devices with Current Sensing

Item No.	Bus	Equipment	Device Type	Quantity
1	Gray Switchgear South	Generator No. 1	51V	3
2	Gray Switchgear South	Generator No. 2	51V	3
3	Gray Switchgear South	Generator No. 3	51V	3
4	Gray Switchgear South	Feeder No. 1	50/51	3
5	Gray Switchgear South	Feeder No. 2	50/51	3
6	Gray Switchgear South	Feeder No. 3	50/51	3
7	Gray Switchgear South	Feeder No. 4	50/51	3
8	Gray Switchgear South	Feeder No. 5	50/51	3
9	Gray Switchgear South	Station Service No. 1	50/51	3
10	Gray Switchgear South	SM1A Tie	50/51	3
11	Gray Switchgear North	Generator No. 4	51V	3
12	Gray Switchgear North	Generator No. 5	51V	3
13	Orange Switchgear	GVEA Transformer	50/51	3
14	Orange Switchgear	GVEA Transformer	46	1
15	Orange Switchgear	Feeder No. 7	50/51	3
16	Orange Switchgear	Feeder No. 8	50/51	3
17	Orange Switchgear	Feeder No. 9	50/51	3
18	Orange Switchgear	Overhead Tie	50/51	3
19	Orange Switchgear	Station Service No. 2	50/51	3
Total				55

It is believed that the current transformers (CTs) will not have to be replaced with smaller ratio CTs. The range of tap settings available on the protective relays will allow them to be reset to the new current values.

With the system configuration changed to a grounded wye, and the Building 606 and Richardson substation step-up transformers rewired to grounded wye configurations on both the primary and secondary, the 7.2 kV system will have ground fault protection, which it presently does not have.

2.2.6.5 Reclosers and Sectionalizers

There are no reclosers or sectionalizers presently installed on the electrical distribution system. One of the many advantages of a grounded system is that the use of reclosers will be possible. Reclosers would reduce outage times and lineman callouts.

2.2.6.6 Capacitors and Reactors

There are no capacitors or reactors presently installed on the electrical distribution system. The power factor (PF) and load factor (LF) are consistently high on the distribution system, eliminating the need for voltage and VAR corrective devices.

2.3 FIELD INVESTIGATIONS

In order to evaluate the physical condition of the electric distribution system, the poles were tested using standard methods and equipment, and the line maintenance personnel were interviewed.

2.3.1 Pole Testing

A random sampling of seven poles were tested, including some of the oldest poles on the base, in order to gain some knowledge about the general condition of the overhead distribution system. EMC has estimated that 1,318 poles exist on the distribution system. Thus, approximately 0.5% of the poles were tested.

The testing was performed on Wednesday and Thursday, August 30 and 31, 1995. The weather was cold (high 30s to low 40s) and raining on Wednesday morning. The weather continued to improve through Thursday afternoon when it became sunny and warm (high 50s to low 60s). EMC was accompanied and assisted by a lineman from the Public Works Department during all pole testing. The test methods, data, and results are detailed below.

2.3.1.1 Test Methods

Four distinct methods were employed in order to evaluate the physical condition of the existing poles. They are described below.

Visual Inspection

The poles were visually inspected for:

- **Checking:** Checks are cracks or splits that develop along the longitudinal axis of the pole as the wood dries. They occur when the pole is not properly seasoned prior to preservative treatment. Checks are a problem because they expose the untreated wood at the center of the pole.
- **Damage incurred from vehicles:** One pole in Test No. 1 had large scars near the butt from snowplows. This pole is located in the middle of a large open parking and maneuvering area which makes it more vulnerable to incidents than others.

- Other abnormalities, such as excessive leaning: None of the poles inspected were leaning excessively.

Butt Drilling

The butts of the poles were drilled down into at a 45° angle starting at approximately 12 inches below the finished grade. A 3/8-inch diameter, 18-inch long ship auger was used with an electric drill. Two determinations are possible using this test method. First, the resistance of the drill as it enters the wood is used to determine if the interior of the pole is rotten. If the drill can be pushed into the wood with little applied force, then there is a strong possibility that the pole interior is rotten. Second, the wood shavings removed from the drill hole reveal the interior composition of the pole. An examination of the wood shavings will indicate the moisture content, and the existence of rot and insects. The drill holes were plugged with a 7/16" diameter, CCA treated, hickory dowel approximately 3 inches long.

Electronic (Sound Wave) Analysis

A Pole Test™ electronic testing device, manufactured by Engineering Data Management, Inc. (EDM) in Fort Collins, Colorado, was used to determine the strength of the pole at the ground line. The device uses sensors on the pole's surface to capture the waveform of a sound wave transmitted through the pole. The sound wave is injected into the pole by striking a metal pin on the pole's surface with a steel ball on a pendulum. The waveform is compared with known waveforms representing specific levels of deterioration of the pole's interior. The digital readout from the device is in psi and represents the strength left in the pole at the test location. The psi value can be compared against the cutoff limit published by EDM for the wood species and construction class of the pole under investigation.

The Pole Test™ unit was developed in conjunction with an Electric Power Research Institute (EPRI) grant to the Colorado State University to study pole failure prediction.

Hammer Strike

The pole was struck several times in several locations with a small sledge hammer. The sound of the strike is also indicative of the pole's condition. A sharp crack or ringing sound indicates a healthy, solid pole. A dull thud or soft sound indicates a rotted pole. The results of this test are more subjective than the first two, but provide additional substantiation to the results of those tests.

2.3.1.2 Data

The seven poles tested were located on the post as follows:

- Test No. 1 - Near Building 162 in the old post area.
- Test No. 2 - Near Building 400 in the middle post area.
- Test No. 3 - Near Building 400 in the middle post area.
- Test No. 4 - Near Building 100 in the old post area at Allen Air Field.
- Test No. 5 - Near the main gate at Big Delta Ave. and Richardson Highway.
- Test No. 6 - On the Bolio Lake line near where the line intersects the main road.
- Test No. 7 - ASP lateral feeder off of Feeder 7 near the sewage lagoon.

The pole data in Table 2-6 below was recorded during the testing. The pole ID, height, class and date were recorded directly from the poles when available. The butt diameter was actually measured with a caliper. The species and treatment type were deduced from color, smell, and other physical factors.

Table 2-6. Pole Data

Test No.	Pole ID	Height (ft)	Class	Date	Species	Diameter @ GL (in)	Preservative Treatment
1	F5L71	40	2	1948	Western Cedar	13.8	Copper
2	F531L4	50	2	1955	Western Cedar	14.3	Copper
3	F5L41	45	2	1985	Douglas Fir	15.2	Creosote
4	F5L88	45	2	1986	Western Cedar	13.0	Copper
5	F9L43	45	2	1957	Douglas Fir	13.6	Penta
6	None	45	3	1975	Western Cedar	13.7	Creosote
7	F7L61	45	3	1977	Douglas Fir	12.3	Unknown

The Pole Test™ data, presented in Table 2-7 below, was collected at the ground line (GL) and perpendicular (P) to the line in all cases except one. Due to site constraints, Test No. 1 was oriented at 45° to in-line (IL) with the line.

Table 2-7. Pole Test Data

Test No.	Visual Insp. Checking	Butt Drilling			Pole Test™			Hammer Strike Sound
		Drill Resist.	Wood Shavings Moisture	Rot	Test Locate	Accel. Orient.	psi	
1	Severe	Moderate	Slight	No	GL	45° to IL	4500	Sharp
2	Severe	Moderate	Slight	No	GL	P	4260	Sharp
3	None	Moderate	Slight	No	GL	P	6180	Sharp
4	Few	Moderate	Slight	No	GL	P	4750	Sharp
5	Moderate	Strong	Slight	No	GL	P	6820	Sharp
6	Moderate	Strong	Slight	No	GL	P	5140	Sharp
7	Few	Strong	Slight	No	GL	P	6710	Sharp

The typical strength limits for evaluating the psi rating of a pole, based on the results of the Pole Test™ unit, vary with the pole species, the construction grade as defined by the National Electrical Safety Code (NESC), and the location on the pole where the test was made, i.e., ground line (GL) or local to some specific point or feature of the pole. Table 2-8 below defines the acceptable strength limits.

Table 2-8. Typical Strength Limits (psi)

	Douglas Fir		Southern Pine		Western Red Cedar	
Grade	GL	Local	GL	Local	GL	Local
B	3040	3400	4160	3390	2180	1900
C (Crossings)	2390	2550	2950	2600	1680	1560
C (Elsewhere)	3770	3960	4550	4110	2560	2450

It is observed that even for the most severe strength limits, the poles tested with the Pole Test™ unit exceed the ratings by more than 60% (the shaded areas in the tables above.) Pole testing notes recorded in the field are provided in Appendix C.

2.3.1.3 Pole Evaluation

Based on the field testing performed by EMC, the poles in the Fort Greely overhead electric distribution system are in good condition despite their age and the harsh environment.

2.3.2 Interviews

Conversations with the overhead line maintenance personnel from the Public Works Department indicated that there have not been any major problems with pole rot at or near the ground. They believe that the main causes of pole failure are damage from snowplows, carpenter ants (on the Cedar poles), and poles being jacked out of the ground by frost heave. They indicated that crossarm rot is prevalent. They have experimented with narrow profile Epoxirod™ construction, but returned to the 8-ft conventional wooden crossarms because the Epoxirod™ construction does not allow adequate working clearance for linemen between the phases. The line maintenance personnel believe that approximately 5% of the wooden crossarms need to be replaced at this time.

The linemen also stated that some 2.4 kV pin insulators still exist on the overhead distribution system, but most have been replaced with 15 kV class insulators. They estimate that approximately 15% of the pin insulators need to be replaced at this time. The insulators are damaged primarily by shot from bird hunter's shotguns. Some old 2.4 kV insulators still exist.

The main problem with the underground distribution system is the underground feeder from Feeder 9 to "the Condos," near the Texas Range. It is the single longest section of underground feeder. Because it was not originally buried deep enough, it is continually being moved to the surface by frost heave. Once on the surface, it is easily damaged requiring frequent splicing. The linemen believe that it should be replaced by an overhead line. As presently installed, it is difficult to maintain and troubleshoot.

2.3.3 Overall Evaluation

The generators and medium voltage switchgear were built in the mid-1950s and mid-1960s. Because the equipment is no longer in current production, it would be difficult or impossible to obtain replacement parts for it. The equipment has been well maintained throughout its service life and is in good condition. Based on plant records, the equipment has always been operated within the rated safe limits and is very reliable.

The overhead distribution system was built between the mid-1940s and the mid-1980s. Much like the generators and medium voltage switchgear, it has always been well maintained and operated within the rated safe limits. The overhead distribution system has been continually upgraded to the extent that most of it is presently suitable for operation at 4.16 kV. The physical condition of the system itself appears to be excellent. In fact, the least desirable part of the system is that it is operated ungrounded at 2.4 kV. Upgrading the distribution system to 4.16 kV would not substantially increase the mechanical loading on the existing poles, crossarms, or insulators. At worst, the addition of a new neutral conductor will require another guy wire at dead-end structures.

3. EXISTING SYSTEM COMPUTER MODELS AND ANALYSIS (1995 TO 1997)

3.1 GENERAL

The existing electrical distribution system was modeled using the Distribution Analysis for Power Planning and Reporting (DAPPER) Program, V4.5, Rev 1.08, as licensed to EMC Engineers, Inc. by SKM Systems Analysis, Inc. of Manhattan Beach, CA. The DAPPER Program is capable of modeling multi-level voltage power systems of any configuration, including radial design, loop design, or any combination of radial and loop design. The DAPPER Program can perform load flow, voltage drop, motor starting, and short circuit studies.

For the purpose of this study, the existing electrical distribution system was modeled and load flow analyses were performed for two cases: the existing system operated at 2400 V, and the existing system operated at 4160 V. The total system losses for each case were determined and compared to find the difference. The difference represents the reduction in losses attainable by operating the system at the higher voltage. The loss reduction can be easily converted to energy saved by multiplying by the average hours in service during the year.

Once the energy savings were known for the first year, the economic model was used to determine the SIR of operating the system at the higher voltage. The present worth of the energy savings was determined over a twenty year life. The construction costs required to modify the system for operation at the higher voltage were determined using the MCACES Program with the 1994 Fairbanks Database. The present worth of the energy savings was then divided by the construction costs, and the result was compared to the Corps of Engineers (COE) acceptable limits to determine the project's feasibility.

The electrical distribution system model and the economic model are described below in greater detail.

3.2 ELECTRICAL DISTRIBUTION SYSTEM MODEL

Before the electrical distribution system could be modeled accurately, several factors had to be determined. These are detailed in the following sections.

3.2.1 Estimated Loads

In order to estimate the system load accurately, data from the records maintained at Building 606 were analyzed. The monthly summary sheets were used to find the time and

date of the yearly peak between August 1, 1994 and July 31, 1995. Once the time and date of the yearly peak was known, the daily log sheets were used to determine the load on each feeder and the system power factor at the time. The yearly peak was determined to be 3456 kW occurring on December 7, 1994, at 12:00 PST. The system power factor was determined to be 95%. Table 3-1 below shows the loads on each feeder for December 7. Appendix D provides the load data sheets.

Table 3-1. Existing System Feeder Load

Feeder No.	Load (A)
1	125
2	122
3	85
4	100
5	60
6	Overhead Tie Bus
7	112
8	100
9	100
Total	804

Spreadsheets were created to calculate the estimated lumped load at each bus for each feeder, provided in Appendix E. The estimated load at each bus was calculated by multiplying the 3 ϕ equivalent kVA by the estimated demand on the feeder. The estimated demand on the feeder was determined by trial and error, i.e., the demand necessary to produce the feeder ampacity, shown in the table above, in the actual computer model. The estimated lumped load is simply the total of all the transformers at a particular bus modeled as a "lump sum."

Lumping the loads at each bus represents a valid model for determining the system losses, since the voltage on the primary distribution system is the only factor that will be altered to reduce the system losses. The load transformer losses will be the same connected at 4.16 kV, grounded wye, as they are connected at 2.4 kV, delta. The secondary voltage on each load transformer will not change--the losses will remain the same. Consequently, it is not necessary to model the load transformers and the secondary loads in detail. Additionally, the feeder loads are based on measured data from plant records.

3.2.2 Load Factor

The load factor must also be considered in order to make the computer model more realistic. The initial loading of the distribution system was developed from the yearly peak. However, the system does not operate at the yearly peak all the time. The load factor times the yearly peak represents the average yearly loading of the system. The load factor for the Fort Greely electrical distribution system was determined by multiplying the daily peak for

each month by 24 (hours) and dividing the product by the sum of the hourly kW readings from the plant totalizer meter. The results for the twelve months were averaged to determine the yearly load factor, which is approximately 80%. Appendices D and K (Estimated Energy Savings) provide load factor calculations.

3.3 CASE STUDIES

Once the correct lumped loads were entered into the DAPPER Program and verified for each feeder, two load flow studies were performed to determine the system losses for each.

3.3.1 Case 1

Case 1 simulated the existing system operating at 2.4 kV with transformers connected in delta, where applicable. The loads were modeled for the 1995 to 1997 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. The lumped loads are modeled as constant impedance loads. This case represents the baseline for the current system.

Appendix F provides for the results of the load flow study. The system losses are shown to be 76.1 kW and 239.2 kVAR.

3.3.2 Case 2

Case 2 simulated the existing system operating at 4.16 kV with transformers connected in grounded wye, where applicable. The loads were modeled for the 1995 to 1997 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. An additional transformer has been added in this case to simulate the losses associated with stepping up the voltage at generators 1, 2, or 3 from 2.4 kV to 4.16 kV. The lumped loads were modeled as constant impedance loads. This case represents the reduced loss case for the current system.

Appendix G provides the results of the load flow study. The system losses are shown to be 44.2 kW and 242.8 kVAR.

3.4 CONSTRUCTION COST ESTIMATE

The construction cost estimates were developed based upon the repair, reconnection, replacement or addition of the distribution equipment as specified below. MCACES was used to develop the cost estimate with the 1994 Fairbanks database of material, labor and equipment costs. When cost information was not available in the MCACES database, vendor quotes or the 1995 Means Electrical Cost Data were used with a 20% location factor

added to account for the extra shipping expenses. Additionally, the following were applied to the construction cost estimate to obtain the final cost:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.
- 4% for price escalation.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is \$994,468. Appendix J provides detailed construction cost estimates. The equipment described below was included or excluded from the cost estimate.

3.4.1 Transformers

In order to operate the system at 4.16 kV, modifications to the distribution system transformers are required. These modifications are presented below.

3.4.1.1 Main Transformer (GVEA)

The main transformer is 3 ϕ , 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV connected YGRD- Δ and is owned and maintained by GVEA. It will be necessary to replace this transformer with a 3 ϕ , 4000 kVA, OA, 24.9/14.4 - 4.16/2.4 kV transformer, connected YGRD-YGRD.

It is assumed for the purpose of this study that this transformer will be replaced by GVEA and the cost of replacement will be amortized over the life of the transformer. Those costs are generally incorporated into a new rate structure. Compared to the other modifications that will be necessary, this cost increase represents an insignificant investment on the part of Fort Greely. No costs have been included in the study for replacement of this transformer.

3.4.1.2 Feeder 9 Step-Up Substation Transformer

Feeder 9 consists of three 1 ϕ , 500 kVA, OA, 2.4/4.16 - 7.2/12.47 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ - Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

3.4.1.3 Richardson Step-Up Substation Transformer

The Richardson transformer consists of three 1 ϕ , 200 kVA, OA, 2.4-7.2 kV transformers with top-mounted primary and secondary bushings, which are presently connected in a Δ - Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

3.4.1.4 Building 606 Station Service Transformers

All four station service transformers at Building 606 will need to be replaced. They can all be replaced as 3 ϕ dry type transformers at their original kVA ratings (2- 300 kVA & 2- 500 kVA) with primary windings of 4.16/2.4 kV connected YGRD, and secondary windings of 480/277 V connected YGRD.

3.4.1.5 Load Transformers

All 69 of the pole type load transformers are suitable for operation at 4.16 kV. The 3 ϕ pole type load transformers are connected in Δ on the primary. They can be reconnected as YGRD at minimal expense. The secondaries will not require modifications.

All 76 1 ϕ pole type transformers are connected phase-to-phase on the primary. They can be reconnected as phase-to-neutral at minimal expense. The secondaries will not require modifications.

In addition, the five pad-mounted transformers will need to be replaced:

Four at 4160/2400-208/120 V, YGRD-YGRD (two 500 kVA; one 225 kVA; one 112.5 kVA).

One at 12470/7200-208/120, YGRD-YGRD (500 kVA).

3.4.2 Overhead Feeders

The modifications required to the overhead distribution system feeders and structures in order to operate the system at 4.16 kV are described below.

3.4.2.1 Poles

No costs have been included in the construction cost estimate for replacement of poles as a result of upgrading the system voltage to 4.16 kV. The existing poles are in good condition.

3.4.2.2 Sagging

No costs have been included in the construction cost estimate for re-sagging the existing conductors as a result of upgrading the system voltage to 4.16 kV. Since the higher operating voltage will actually reduce the load current on the feeders, the normal operating sag will be reduced. There are some isolated spots where adequate clearance does not presently exist over roadways. These should be addressed with normal maintenance funds.

3.4.2.3 Crossarms

The existing crossarms are 8 ft in length as a minimum and provide adequate clearance for 4.16 kV operations. It is estimated that 5% (66) of the system crossarms need to be replaced at this time. The crossarm replacement is necessitated by normal rot experienced in the Alaska environment and not by the voltage upgrade. Since the cost is negligible, it has been included in the construction cost estimate.

3.4.2.4 Insulators

It is estimated that approximately 15% (594) of the system insulators are the old, 2400 V rated, glass insulators. All of these insulators should be replaced with 15 kV rated insulators. The cost for upgrading the system voltage has been included in the construction cost estimate.

3.4.2.5 Conductors

No costs have been included in the construction cost estimate for replacement of existing phase conductors. A new 4/0 AWG, ACSR neutral conductor and one new insulator per pole will need to be added to the overhead distribution system. The neutral will need to be grounded at 4 poles per mile, minimum. The cost of the new neutral, insulator, and grounds has been included in the construction cost estimate.

3.4.2.6 Guys

With the addition of the new neutral conductor, an additional guy wire may be necessary at dead-end and corner structures. The cost of this work is covered under the contingency.

3.4.3 Underground Feeders

No costs have been included in the construction cost estimate for modifications to any of the underground distribution feeders.

3.4.4 Generators

Generators 1, 2, and 3 will each require a 3 ϕ , 1500 kVA, 2400-4160/2400 V, Δ -YGRD step-up transformer in order to connect to the new grounded, higher voltage distribution system.

Generators 4 and 5 can be reconnected in a grounded wye configuration at their output terminals at minimal expense.

The costs of these modifications have been included in the construction cost estimate for upgrading the system voltage.

3.4.5 Medium Voltage Switchgear

No costs have been included in the construction cost estimate for modifications to the existing medium voltage switchgear.

3.4.6 Miscellaneous Equipment

The modifications required to the miscellaneous system equipment in order to operate the system at 4.16 kV are described below.

3.4.6.1 Richardson Step-Up Substation Breaker

This breaker will need to be replaced with a new oil circuit breaker rated for operation at 15 kV. The cost of this new breaker has been included in the construction cost estimate for upgrading the system voltage.

3.4.6.2 Load Break Air Switches

No costs have been included in the construction cost estimate for modifications to the existing load break air switches.

3.4.6.3 Cutout Switches

No costs have been included in the construction cost estimate for modifications to the existing cutout switches. Modifications required to fuse sizes will be covered under the contingency.

3.4.6.4 Protective Relays

A new Protective Device Coordination Study will be necessary and the existing relays will need to be reset. No costs have been included in the construction cost estimate specifically for these modifications. The cost of these modifications will be covered under the contingency.

3.4.6.5 Reclosers and Sectionalizers

No costs have been included in the construction cost estimate for modifications to reclosers or sectionalizers.

3.4.6.6 Capacitors and Reactors

No costs have been included in the construction cost estimate for modifications to capacitors or reactors.

3.5 ECONOMIC MODEL

The economic model used to calculate the Saving-to-Investment Ratio (SIR) was taken from the standard COE Life Cycle Cost Analysis (LCCA) Summary sheet developed for the Energy Conservation Investment Program (ECIP). The energy costs used are defined below. The construction cost estimates were described above.

3.5.1 Energy Costs

The energy costs used to calculate the energy savings were taken from the "Energy Usage and Cost Provided to Ft. Greely by GVEA" table (GVEA table) in Appendix K. The GVEA table was developed from GVEA's monthly billings to Fort Greely for the year beginning on September 1, 1993 and ending on August 31, 1994. The statements are also provided in Appendix K.

Fort Greely's energy costs are based on GVEA's GS-2 Rate Schedule, GVEA's wheeling charges, and the cost of generating electricity at Fort Wainwright. Rate schedules and calculations are provided to justify the numbers used in this study.

The average yearly energy cost for the purpose of this study was calculated as shown in Note 14 of the GVEA table. Approximately 85% of the power used by Fort Greely was generated at Fort Wainwright and wheeled to Fort Greely, and the remaining 15% was

purchased directly from GVEA. The average yearly energy cost was calculated by adding the two energy costs, each weighted by their respective percentages listed above.

The cost of power generated at Fort Wainwright and wheeled to Fort Greely was determined by multiplying the cost of generation at Fort Wainwright (\$0.06/kWh) by the energy wheeled to Fort Greely (13,814,340 kWh) and adding to it the wheeling charge (17.64% of the GS-2 Rate Schedule), and multiplied by the energy wheeled to Fort Greely. The cost of GVEA power was determined by taking the total charges from GVEA (\$528,806), subtracting their wheeling charges (\$185,347), and dividing the difference by the total energy purchased from GVEA (2,503,020 kWh). This incorporates the demand charges into the energy charges over the entire year for convenience.

Based on the above calculation, the average yearly energy cost for Fort Greely is \$0.0832 per kWh.

3.5.2 Economic Life and Discount Factor

The recommended economic life chosen for this project was 20 years based on Type 8, Electrical Energy Systems, from the Energy Conservation Project Types sheet in Appendix K.

The discount factor chosen was 14.47 Table Ba-4. This table is for Census Region 4 which includes Alaska and the DOE Discount Rate used is 4.1 percent as stated on the table.

These are the numbers that will be used in the LCCA.

3.5.3 Estimated Energy Savings

The estimated energy savings were calculated by subtracting the average line losses determined in the Case 2 Load Flow Analysis from the average line losses determined in the Case 1 Load Flow Analysis. In order to convert the peak power (kW) losses on the system to average annual energy (kWh) losses, the peak system losses were multiplied by the system load factor and the number of hours per year.

The average annual energy saved per year by converting the electrical distribution system from 2400 V to 4160 V is 222,330 kWh. Refer to the "Estimated Energy Savings" sheets in Appendix K.

3.5.4 LCCA

The standard COE LCCA was prepared using the numbers defined above. An additional 5.5% for supervision and inspection overhead (SIOH) and 6.0% for design costs were added to the total construction costs in the LCCA. This final sum represents the total investment

required to upgrade the electrical distribution system from a 2400 V, ungrounded delta to a 4160 V grounded wye. The total investment is \$961,414.

The energy savings in dollars per year is \$18,498. This number is calculated by multiplying the average annual energy saved per year at the base by the average yearly energy cost. The number is multiplied by the uniform present value (UPV) discount factor, which represents the total energy savings in dollars over the twenty year life of the project, reflected into the first year. This number calculates to \$267,664.

A summary of the LCCA is shown below.

Table 3-2. LCCA Results for Existing System

Description	Existing System
Annual Energy Savings (kWh)	222,330
Annual Cost Savings (\$)	18,498
Investment Cost (\$)	1,108,832
Simple Payback (yrs)	59.9
SIR	0.24

There are no discernible non-energy savings in this project. The age and voltage (2400 V) of most of the existing equipment that will be replaced renders the salvage value negligible. Likewise, there is no public utility rebate for the improvements under consideration in this report.

The SIR for this project is 0.24. Since this value is less than 1.25, the project does not qualify for implementation under the ECIP Program.

4. REDUCED SYSTEM DESCRIPTION (POST 2001)

4.1 GENERAL

The Department of Defense has targeted Fort Greely for realignment under the Base Realignment and Closure (BRAC) Program. The base realignment will significantly reduce the number of active facilities on the site over a five year period, starting in 1997 and ending in 2001. This reduction in facilities will have a significant impact on the utilization of the electrical distribution system and, consequently, the energy savings achievable.

4.2 DETAILS

The major features of each of the electric distribution systems are described in detail below as they will exist after realignment. The post-realignment system will be referred to as the reduced system.

4.2.1 Buildings

There are currently 231 buildings located on Fort Greely, the majority of which will be "laid-away" under the Layaway Program for disposition or eventual demolition. Twenty-eight buildings have been identified for retention to support the residual force to be left at Fort Greely. These buildings total 245,937 sq ft consisting of the buildings associated with the primary base services, such as fire protection, central power and heating plant, police, headquarters, sewage plant, school, gymnasium, housing, roads and grounds, etc.

Twenty-five of these buildings receive electric service via the base distribution system. Only 16 buildings are located in the cantonment area. The nine remote sites are located in the Bolio Lakes and Ranges area southwest of the base. Three buildings located in the Black Rapids area do not receive electric service via the base distribution system, and were not considered in this study.

4.2.2 Transformers

The residual buildings will be supplied by a total of 66 transformers from the Fort Greely electric distribution system. Of those transformers, 56 actually supply building loads, six are step-up substation transformers on Feeder. 9, and four are station service transformers for Building 606. All remaining transformers are described in detail below.

4.2.2.1 Main Transformer (GVEA)

The main transformer supplies the base from the GVEA distribution system. It is a 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV, YGRD- Δ substation class transformer with top mounted primary and secondary bushings. This transformer is located adjacent to Building 606, and is owned and maintained by GVEA. It is not included as part of the 66 transformers described above, but will remain after realignment.

This transformer will need to be replaced if the Fort Greely electric distribution system is upgraded to 4.16 kV, grounded wye. It will be necessary to coordinate with GVEA on the exact winding configuration.

4.2.2.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 substation consists of 3, 1 ϕ , 500 kVA, OA, 2.4/4.16 - 7.2/12.47 kV pole-mounting type transformers, connected Δ - Δ , with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad adjacent to Building 606, and will remain after realignment.

These transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused if the system voltage is increased to 4.16 kV. This will increase the Feeder 9 voltage from 7200 V to 12,470 V.

4.2.2.3 Richardson Step-Up Substation Transformer

The Richardson substation consists of three 1 ϕ , 200 kVA, OA, 2.4 - 7.2 kV pole-mounting type transformers, connected Δ - Δ , with top mounted primary and secondary bushings. The transformers are mounted on a concrete pad near the Richardson Highway in the West Post area.

The nameplate on the transformers does not specifically indicate that the transformers are rated for operation at 4.16 kV and 12.47 kV. However, EMC believes that these transformers can be rewired as a grounded wye (YGRD) on both the primary and secondary and reused at 4.16 kV and 12.47 kV respectively. The winding voltage and insulator bushing ratings will not change and the phase-to-phase clearance is adequate. It will be necessary to rewire these transformers to match the Feeder 9 step-up transformer voltage. These transformers will remain after realignment.

4.2.2.4 Building 606 Station Service Transformers

Building 606, is supplied by four station service transformers: SS-1, SS-2, and two SM1As. Transformer SS-1 is a 300 kVA dry type transformer. Transformer SS-2 is a 300 kVA pad

mounted transformer. Both SM1A transformers are 500 kVA dry type transformers. All four transformers are 3 ϕ , 2400-480 V, Δ - Δ , and will remain after realignment. They will all need to be replaced if the system voltage is upgraded to 4.16 kV, because they cannot be rewired.

4.2.2.5 Load Transformers

From the 56 load supplying transformers mentioned above, 1 is a 3 ϕ pad mounted transformers, 51 are connected into 17, 3 ϕ transformer banks, and the remaining 4 are 1 ϕ transformer banks. Table 4-1 below shows the transformer voltages, sizes, quantities, and mounting type. All 3 ϕ transformers are connected Δ -YGRD and 1 ϕ transformers are connected ϕ - ϕ on the primary with a center tapped secondary.

Table 4-1. Remaining Load Transformers
(Permanent Activity Facility list as of July 25, 1995)

Bldg. No.	Bldg. Name	Location	No. Trans. Banks	Trans. Bank kVA	No. of Trans./ Bank	ϕ	Mt. Type	VPRI	VSEC
110	POL Monitoring	North Post	1	75	3	3	Pole	2400	208/120
501	Headquarters	Cantonment	1	225	3	3	Pole	2400	208/120
503	Gymnasium	Cantonment	1	225	3	3	Pole	2400	208/120
504	Fire Station	Cantonment	1	112.5	3	3	Pole	2400	208/120
605	Consol. PW	Cantonment	1	300	3	3	Pole	2400	208/120
606	Central Htg. Plant	Cantonment	1	150	3	3	Pole	2400	480/277
607	Heat Plant Annex	Cantonment							
615	Roads & Grounds	Cantonment	1	150	3	3	Pole	2400	208/120
617	POL Operation	Cantonment							
618	POL Operation	Cantonment	1	75	3	3	Pole	7200	208/120
633	Sewage Treat.	Cantonment	1	30	3	3	Pole	2400	208/120
638	Sewage Lagoon	Cantonment	1	75	3	3	Pole	2400	480/277
639	Contact Chamber	Cantonment							
725	State School	Cantonment	1	225	3	3	Pole	2400	208/120
820	Unac. Pers. Hsg.	Cantonment	2	37.5	1	1	Pole	2400	240/120
821	Unac. Pers. Hsg.	Cantonment	1	75	1	1	Pole	2400	240/120
1343	Range	Beales	1	30	3	3	Pole	7200	208/120
1350	Range	Beales	1	75	3	3	Pole	7200	208/120
1352	Range	Beales							
1419	Range	Mississippi	1	112.5	3	3	Pole	7200	208/120
			1	30	3	3	Pole	7200	208/120
1600	Range	Texas	1	75	3	3	Pole	7200	208/120
1605	Range	Texas	1	15	1	1	Pole	7200	240/120
1606	Range	Texas							
1928	CRTA Complex	Bolio Lake	1	500	1	3	Pad	7200	208/120
1930	CRTA Complex	Bolio Lake	1	150	3	3	Pole	7200	208/120
2013	NWTC Complex	Black Rapids	Not served from the base distribution system.						
2019	NWTC Complex	Black Rapids							
2026	NWTC Complex	Black Rapids							

All pad-mounted transformers will need to be replaced if the distribution system voltage is increased to 4.16 kV and 12.47 kV. The 3 ϕ , pole-mounted transformer primaries can be

rewired to a grounded wye configuration and reused. The 1 ϕ , pole mounted transformers can be rewired from ϕ - ϕ to ϕ -N and reused. The winding voltage and insulator bushing ratings will not change.

4.2.3 Feeders

The load transformers are supplied by six feeders comprised of 23.1 miles of overhead lines and 3.4 miles of underground lines. Feeders 3, 4, and 8 from the original distribution system are no longer required and are taken completely out of service. Several other feeders are reduced in overall length. The electric distribution system is operated as an ungrounded delta at 2400 volts, 3 ϕ . Table 4-2 shows the feeder characteristics.

Table 4-2. Feeder Descriptions

Feeder No.	Length & Size				Voltage	Connected kVA	
	OH (ft)	AWG	UG (ft)	AWG	L-L	3 ϕ	1 ϕ
1	5050	4/0	0	-	2400	225	150
2	1550	4/0	0	-	2400	562.5	0
3	0	4/0	0	-	2400	0	0
4	0	4/0	0	-	2400	0	0
5	8400	4/0	2400	2	2400	75	0
6	0	Bus	0	-	2400	0	0
7	3550	4/0	0	-	2400	705	0
8	0	4/0	2000	4/0	2400	0	0
9	103,418	2	13,552	2	7200	1017.5	25
Totals	121,968		17,952			2585	175

Approximately 94% of the connected load will be three-phase after realignment. It is assumed that the single-phase loads will remain well balanced between phases. In general, the feeders will supply the same loads and locations as previously described, except the loads that have been eliminated:

- Feeder No. 1 - Housing in the main base area.
- Feeder No. 2 - Offices and shops in the main base area.
- Feeder No. 3 - No load
- Feeder No. 4 - No load
- Feeder No. 5 - Old and middle post areas; Allen Air Field.
- Feeder No. 6 - Overhead tie.
- Feeder No. 7 - Sewage plant and east base area.
- Feeder No. 8 - No load
- Feeder No. 9 - Remote sites; Bolio Lakes and the Ranges.

4.2.3.1 Overhead Feeder Construction

Approximately 87% of the electric distribution system, by feeder length, will be overhead construction after realignment. The overhead electric distribution system construction is the same as previously described in Section 2.

None of the phase conductors will have to be replaced if the system voltage is upgraded to 4.16 kV and 12.47 kV. The load current will actually be decreased at the higher voltages. The previous assumption will be made, that 5% of the crossarms will have to be replaced and 15% of the pin insulators. A new neutral conductor will have to be added as well.

4.2.3.2 Underground Feeder Construction

The remaining 13% of the electric distribution system is underground construction. The underground electric distribution system is constructed as previously described in Section 2.

It is not necessary to replace the feeders or add an additional wire for a neutral if the system voltage is upgraded to 4.16 kV and 12.47 kV. The three-phase feeders supply balanced three-phase loads. No single-phase loads were supplied by underground feeders.

4.2.4 Generators

The five diesel engine generators located in Building 606 will remain after realignment. Generators 1, 2, and 3 are alike and generators 4 and 5 are alike. Table 4-2 is a summary of the generators characteristics.

Table 4-3. Characteristics of Engine Generators

Gen. No.	Rated kVA	PF	Rated kW	rpm	ϕ	Voltage	Mfr.	Ser. No.	Output Connect.
1	1250	0.8	1000	360	3	2400	Elliott Co.	3-S-9691	Y
2	1250	0.8	1000	360	3	2400	Elliott Co.	2-S-9691	Y
3	1250	0.8	1000	360	3	2400	Elliott Co.	1-S-9691	Y
4	1563	0.8	1250	360	3	2400/4160	Elliott Co.	4-S-10915	Δ
5	1563	0.8	1250	360	3	2400/4160	Elliott Co.	7-S-10915	Δ

The generators are usually operated as peak shavers to reduce the load on the GVEA main transformer. The total connected load on the reduced system, counting the load and station service transformers is approximately 4160 kVA. If the traditional operating characteristics of the base load are assumed, i.e., 95% power factor and 25% demand factor, the peak base load will be approximately 988 kW. Hence, the main GVEA transformer will be more than

adequately sized and generators 4 and 5 are each large enough to provide stand-by power to the reduced base with one unit in reserve.

All of the generators are 6-lead machines. Generators 1, 2, and 3 are connected in an ungrounded Y configuration, meaning that the T1, T2, and T3 leads are connected to phases A, B, and C respectively and the T4, T5, and T6 leads are tied together at a common neutral bus is not bonded to ground. This indicates that the windings are only rated for 1386 V. If these generators are to be used on a 4160 V, grounded wye system, they will require a 2.4 - 4.16 kV, Δ -YGRD step-up transformer.

Generators 4 and 5, on the other hand, are connected in a delta configuration, meaning that the T1 and T3 leads are tied together, the T2 and T4 leads are tied together, and the T3 and T5 leads are tied together. This indicates that the windings are rated for 2400 V and that these generators can be used on a 4160 V, grounded wye system by reconnecting the leads from a delta configuration to a grounded wye configuration.

If generators 4 and 5 alone were kept for stand-by purposes, and generators 1, 2 and 3 were laid-away, a considerable savings could be realized when upgrading the system to 4160 V, by not having to install a new transformer at each of generators 1, 2 and 3. The economic impact of this decision is discussed in Section 6.

4.2.5 Medium Voltage Switchgear

The main switchgear at Building 606 will remain the same as previously described after realignment. The equipment ratings will not change and the fault levels will remain substantially the same. As previously described, the high first half cycle fault levels are not expected to be a problem.

It will not be necessary to replace any of the switchgear if the system voltage is upgraded to 4.16 kV. The existing switchgear is rated for 4.16 kV and the bus ampacities will be more than adequate, since the load current will be reduced to 58% of its present value at the higher voltage. Additionally, the available fault currents will decrease with the increased voltage.

4.2.6 Miscellaneous Equipment

4.2.6.1 Richardson Step-Up Substation Breaker

The oil circuit breaker at this location is an Allis Chalmers Type OX-18 (Serial No. 305756). It is rated for 600 A continuous current, 7.2 kV and 75 kV BIL. It was manufactured in December 1955. Since it is only rated for 7.2 kV phase-to-phase, it will have to be replaced with a switch rated for 15 kV phase-to-phase.

4.2.6.2 Load Break Air Switches

These sectionalizer switches are relatively new additions to the overhead distribution system and are A B Chance, Type D, Catalogue No. CD7HE1CL. They are rated for 600 A continuous current, 40 kA momentary current, 15 kV, and 110 kV BIL. These switches will not have to be replaced if the system voltage is increased to 4.16 and 12.47 kV.

4.2.6.3 Cutout Switches

Each load transformer is protected by an XS style cutout switch. The rating of the cutouts is not known, however, they have only been available in a 15 kV rating for many years. In addition, a 200 A continuous current rating is commonly used on overhead distribution systems, especially in conjunction with 4/0 ACSR. Therefore, it is assumed that the cutouts are rated at 200 A continuous current, 15 kV, and 110 kV BIL, the standard rating available from most manufacturers. While the cutouts will not have to be replaced, their fuses will all have to be replaced if the voltage is upgraded to 4.16 kV and 12.47 kV. The National Electrical Code (NEC, Table 450-3(a)(1)) requires that the continuous current rating of the primary protection for a transformer not exceed 300% of the rated continuous primary current of the transformer. Since the primary current of the transformer will be reduced to 58% of its original value because of the voltage increase, all of the fuses will be too large.

4.2.6.4 Protective Relays

A Protective Device Coordination Study was recently performed and the protective devices reset to the recommended values. If the system voltage is increased, the load and fault current levels will all change. This will require that any current sensing type protective device be reset in order to maintain coordinated tripping and to ensure proper protection. Table 4-4 below shows the devices with current sensitive tripping that will need to be reset.

Table 4-4. Protective Devices With Current Sensing

Item No.	Bus	Equipment	Device Type	Quantity
1	Gray Switchgear South	Generator No. 1	51V	3
2	Gray Switchgear South	Generator No. 2	51V	3
3	Gray Switchgear South	Generator No. 3	51V	3
4	Gray Switchgear South	Feeder No. 1	50/51	3
5	Gray Switchgear South	Feeder No. 3	50/51	0
6	Gray Switchgear South	Feeder No. 4	40/51	0
7	Gray Switchgear South	Feeder No. 2	50/51	3
8	Gray Switchgear South	Feeder No. 5	50/51	3
9	Gray Switchgear South	Station Service No. 1	50/51	3
10	Gray Switchgear South	SM1A Tie	50/51	3
11	Gray Switchgear North	Generator No. 4	51V	3

Item No.	Bus	Equipment	Device Type	Quantity
12	Gray Switchgear North	Generator No. 5	51V	3
13	Orange Switchgear	GVEA Transformer	50/51	3
14	Orange Switchgear	GVEA Transformer	46	1
15	Orange Switchgear	Feeder No. 7	50/51	3
16	Orange Switchgear	Feeder No. 8	50/51	0
17	Orange Switchgear	Feeder No. 9	50/51	3
18	Orange Switchgear	Overhead Tie	50/51	3
19	Orange Switchgear	Station Service No. 2	50/51	3
Total				46

The quantity to be reset is slightly less than described in Section 2 for the existing system, because three feeders are assumed to be out of service due to the reduced facility. It is believed that the CTs will not need to be replaced with smaller ratio CTs. The range of tap settings available on the protective relays will allow them to be reset to the new current values.

With the system configuration changed to a grounded wye, and the Building 606 and Richardson substation step-up transformers rewired to grounded wye configurations on both the primary and secondary, the 7.2 kV system will have ground fault protection, which it presently does not have.

4.2.6.5 Reclosers and Sectionalizers

There are no reclosers or sectionalizers presently installed on the electrical distribution system. One of the many advantages of a grounded system is that the use of reclosers will be possible. Reclosers would reduce outage times and lineman callouts.

4.2.6.6 Capacitors and Reactors

There are no capacitors or reactors presently installed on the electrical distribution system. The power factor (PF) and load factor (LF) are consistently high on the distribution system, eliminating the need for voltage and VAR corrective devices.

5. REDUCED SYSTEM COMPUTER MODELS AND ANALYSIS (POST 2001)

5.1 GENERAL

The reduced electrical distribution system was modeled in the Distribution Analysis for Power Planning and Reporting (DAPPER) Program, V4.5, Rev 1.08, as licensed to EMC Engineers, Inc. by SKM Systems Analysis, Inc. of Manhattan Beach, CA. The DAPPER Program is capable of modeling multi-level voltage power systems of any configuration, including radial design, loop design, or any combination of radial and loop design. The DAPPER Program can perform load flow, voltage drop, motor starting and short circuit studies.

For the purpose of this study, the reduced electrical distribution system was modeled and load flow analyses were performed for two cases: the reduced system operated at 2400 V, and the reduced system operated at 4160 V. The total system losses for each case were determined and compared to find the difference. The difference represents the reduction in losses attainable by operating the system at the higher voltage. The loss reduction can be easily converted to energy saved by multiplying by the average hours in service during the year.

Once the energy savings were known for the first year, the economic model was used to determine the savings-to-investment ratio (SIR) of operating the system at the higher voltage. The present worth of the energy savings was determined over a twenty year life. The construction costs required to modify the system for operation at the higher voltage were determined using the MCACES Program with the 1994 Fairbanks Database. The present worth of the energy savings was then divided by the construction costs, and the result was compared to the Corps of Engineers (COE) acceptable limits to determine the feasibility of the project.

The electrical distribution system model and the economic model are described below in greater detail.

5.2 ELECTRICAL DISTRIBUTION SYSTEM MODEL

Before the electrical distribution system could be modeled accurately, several factors had to be determined. These are detailed in the following sections.

5.2.1 Estimated Loads

In order to estimate the system load accurately to model the reduced system, the data used in the existing system model from Section 3 was modified as follows:

- Transformers for buildings to be laid-away were taken out of service.
- Feeders with no building loads remaining were taken out of service.
- Estimated demand for each feeder still in service in the reduced system model was assumed to be the same as in the existing system model.
- Power Factor for each feeder still in service in the reduced system model was assumed to be the same as in the existing system model.

The data used in the reduced system model in was developed from the lumped load calculations used for the existing system model. Table 5-1 below shows the feeder loads used in the reduced system computer model. The data sheets are provided in Appendix D.

Table 5-1. Feeder Load for Reduced Systems

Feeder No.	Load (A)
1	40
2	55
3	0
4	0
5	2
6	Overhead Tie Bus
7	49
8	0
9	21
Total	167

Spreadsheets were created to calculate the estimated lumped load at each bus for each feeder, provided in Appendix E as the Lumped Load Calculation Post 2001 Study. The estimated load at each bus was calculated by multiplying the 3 Phase Equivalent kVA by the estimated demand on the feeder. The estimated demand on each feeder was left the same as used in the existing system model. The estimated lumped load is simply the total of all the transformers at a particular bus modeled as a "lump sum."

Lumping the loads at each bus represents a valid model for determining the system losses, since the voltage on the primary distribution system is the only factor that will be altered to reduce the system losses. The load transformer losses will be the same connected at 4.16 kV, grounded wye as they are connected at 2.4 kV, delta. The secondary voltage on each

load transformer will not change, so the losses will remain the same. Consequently, it is not necessary to model the load transformers and the secondary loads in detail. Additionally, the feeder loads are based on measured data from plant records.

5.2.2 Load Factor

The load factor that must be considered in order to make the computer model more realistic, and that is the load factor. The initial loading of the distribution system was developed from the yearly peak. The system does not operate at the yearly peak all the time, however. The load factor times the yearly peak represents the average yearly loading of the system. The load factor for the Fort Greely electrical distribution system was determined by multiplying the daily peak for each month times 24 (hours) and dividing the product by the sum of the hourly kW readings from the plant totalizer meter. The results for the twelve months were averaged to determine the yearly load factor, which is approximately 80%. The assumption was made that the yearly load factor will remain the same after realignment has reduced the base. Load factor calculations are provided in Appendices D and K (Estimated Energy Savings).

5.3 CASE STUDIES

Once the correct lumped loads were entered into the DAPPER Program and verified for each feeder, two load flow studies were performed to determine the system losses for each.

5.3.1 Case 3

Case 3 simulated the reduced system operating at 2.4 kV with transformers connected in delta where applicable. The loads were modeled for the Post 2001 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. The lumped loads are modeled as constant impedance loads. This case represents the baseline for the reduced system.

Appendix H provides the results of the load flow study. The system losses are shown to be 13.6 kW and 13.9 kVAR.

5.3.2 Case 4

Case 4 simulated the reduced system operating at 4.16 kV with transformers connected in grounded wye where applicable. The loads were modeled for the Post 2001 scenario as described above. One standby generator is running at 1000 kW and the remainder of the load is supplied through the GVEA transformer. An additional transformer has been added in this case to simulate the losses associated with stepping up the voltage at

generators 1, 2, or 3 from 2.4 kV to 4.16 kV. The lumped loads were modeled as constant impedance loads. This case represents the reduced loss case for the reduced system.

The results of the load flow study are provided in Appendix I. The system losses are shown to be 11.2 kW and 44.1 kVAR.

5.4 CONSTRUCTION COST ESTIMATE

The construction cost estimates were developed based upon the repair, reconnection, replacement or addition of the distribution equipment as specified below. MCACES was used to develop the cost estimate with the 1994 Fairbanks database of material, labor and equipment costs. When cost information was not available in the MCACES database, vendor quotes or the 1995 Means Electrical Cost Data were used with a 20% location factor added to account for the extra shipping expenses. Additionally, the following adders were applied to the construction cost estimate to obtain the final cost:

- 15% for contractor's overhead.
- 10% for contractor's profit.
- 3% for contractor's bond.
- 20% for contingency.
- 4% for price escalation.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is \$714,073.

Detailed construction cost estimates are provided in Appendix J. The equipment described below was included or excluded from the cost estimates.

5.4.1 Transformers

The modifications required to the distribution system transformers in order to operate the system at 4.16 kV are described below.

5.4.1.1 Main Transformer (GVEA)

The main transformer is 3 ϕ , 2500/3125 kVA, OA/FA, 24.9/14.4 - 2.4 kV transformer is connected YGRD- Δ and is owned and maintained by GVEA. It will be necessary to replace this transformer with a 3 ϕ , 4000 kVA, OA, 24.9/14.4 - 4.16/2.4 kV transformer, connected YGRD-YGRD.

The size of this transformer could be reduced to 2000 kVA due to the reduced load. It was assumed, however, that the facilities that are laid-away could be reactivated in an

emergency, and capacity will need to be available. It is also assumed for the purpose of this study that this transformer will be replaced by GVEA and the cost of replacement will be amortized over the life of the transformer. Those costs are generally incorporated into a new rate structure. Compared to the other modifications that will be necessary, this cost increase represents an insignificant investment on the part of Fort Greely. No costs have been included in the study for replacement of this transformer.

5.4.1.2 Feeder 9 Step-Up Substation Transformer

The Feeder 9 transformer will be required in the reduced system. It consists of three 1 ϕ , 500 kVA, OA, 2.4/4.16 -7.2/12.47 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ - Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

5.4.1.3 Richardson Step-Up Substation Transformer

The Richardson transformer will be required in the reduced system. It consists of three 1 ϕ , 200 kVA, OA, 2.4-7.2 kV transformers with top mounted primary and secondary bushings, which are presently connected in a Δ - Δ configuration. They can be reconnected in a YGRD-YGRD configuration at minimal expense.

5.4.1.4 Building 606 Station Service Transformers

All four station service transformers will be required in the reduced system, but will need to be replaced. They can all be replaced as 3 ϕ dry type transformers at their original kVA ratings (2- 300 kVA & 2- 500 kVA) with primary windings of 4.16/2.4 kV connected YGRD, and secondary windings of 480/277 V connected YGRD.

5.4.1.5 Load Transformers

All 51 pole type load transformers are suitable for operation at 4.16 kV. The 3 ϕ pole type load transformers are connected in Δ on the primary. They can be reconnected as YGRD at minimal expense. The secondaries will not require modifications.

Four 1 ϕ pole type transformers are connected phase-to-phase on the primary. They can be reconnected as phase-to-neutral at minimal expense. The secondaries will not require modifications.

One pad-mounted transformer will need to be replaced on the 3 ϕ , 500 kVA unit at Bolio Lakes.

5.4.2 Overhead Feeders

The modifications required to the overhead distribution system feeders and structures in order to operate the system at 4.16 kV are described below.

5.4.2.1 Poles

No costs have been included in the construction cost estimate for replacement of poles as a result of upgrading the system voltage to 4.16 kV. The existing poles are in good condition.

5.4.2.2 Sagging

No costs have been included in the construction cost estimate for re-sagging the existing conductors as a result of upgrading the system voltage to 4.16 kV. Since the higher operating voltage will actually reduce the load current on the feeders, the normal operating sag will be reduced. There are some isolated spots where adequate clearance does not presently exist over roadways. These should be addressed with normal maintenance funds.

5.4.2.3 Crossarms

The existing crossarms are 8 ft in length as a minimum and provide adequate clearance for 4.16 kV operations. It is estimated that 5% (49) of the system crossarms need to be replaced at this time. The crossarm replacement is necessitated by normal rot experienced in the Alaska environment and not by the voltage upgrade. Since the cost is negligible, it has been included in the construction cost estimate.

5.4.2.4 Insulators

It is estimated that approximately 15% (440) of the system insulators are the old, 2400 V rated, glass insulators. All of these insulators should be replaced with 15 kV rated insulators. The cost for upgrading the system voltage has been included in the construction cost estimate.

5.4.2.5 Conductors

No costs have been included in the construction cost estimate for replacement of existing phase conductors. A new 4/0 AWG, ACSR neutral conductor and one new insulator per pole will need to be added to the overhead distribution system. The neutral will need to be grounded at 4 poles per mile, minimum. The cost of the new neutral, insulator, and grounds has been included in the construction cost estimate.

5.4.2.6 Guys

With the addition of the new neutral conductor, an additional guy wire may be necessary at dead-end and corner structures. The cost of this work is covered under the contingency.

5.4.3 Underground Feeders

No costs have been included in the construction cost estimate for modifications to any of the underground distribution feeders.

5.4.4 Generators

Generators 1, 2, and 3 will each require a 3 ϕ , 1500 kVA, 2400-4160/2400 V, Δ -YGRD step-up transformer in order to connect to the new grounded, higher voltage distribution system.

Generators 4 and 5 can be reconnected in a grounded wye configuration at their output terminals at minimal expense.

The costs of these modifications have been included in the construction cost estimate for upgrading the system voltage. Additional cost savings could be realized by laying-away generators 1, 2 and 3.

5.4.5 Medium Voltage Switchgear

No costs have been included in the construction cost estimate for modifications to the existing medium voltage switchgear.

5.4.6 Miscellaneous Equipment

The modifications required to the miscellaneous system equipment in order to operate the system at 4.16 kV are described below.

5.4.6.1 Richardson Step-Up Substation Breaker

This breaker will need to be replaced with a new oil circuit breaker rated for operation at 15 kV. The cost of this new breaker has been included in the construction cost estimate for upgrading the system voltage.

5.4.6.2 Load Break Air Switches

No costs have been included in the construction cost estimate for modifications to the existing load break air switches.

5.4.6.3 Cutout Switches

No costs have been included in the construction cost estimate for modifications to the existing cutout switches. Modifications required to fuse sizes will be covered under the contingency.

5.4.6.4 Protective Relays

A new Protective Device Coordination Study will be necessary and the existing relays will need to be reset. No costs have been included in the construction cost estimate specifically for these modifications. The cost of these modifications will be covered under the contingency.

5.4.6.5 Reclosers and Sectionalizers

No costs have been included in the construction cost estimate for modifications to reclosers or sectionalizers.

5.4.6.6 Capacitors and Reactors

No costs have been included in the construction cost estimate for modifications to capacitors or reactors.

The total construction cost for converting the electrical distribution system from 2400 V to 4160 V is \$714,073.

5.5 ECONOMIC MODEL

The economic model used to calculate the Saving-To-Investment Ratio (SIR) was taken from the standard COE Life Cycle Cost Analysis (LCCA) Summary sheet developed for the Energy Conservation Investment Program (ECIP). The energy costs used are defined below, and the construction cost estimates were described above.

5.5.1 Energy Costs

The energy costs used to calculate the energy savings were taken from the "Energy Usage and Cost Provided to Ft. Greely by GVEA" table (GVEA table) in Appendix K. The table was developed from GVEA's monthly billings to Fort Greely for the year beginning on September 1, 1993 and ending on August 31, 1994. The statements are provided in Appendix K.

Fort Greely's energy costs are based on GVEA's GS-2 Rate Schedule, GVEA's wheeling charges, and the cost of generating electricity at Fort Wainwright. Rate schedules and calculations are provided to justify the numbers used in this study.

The average yearly energy cost for the purpose of this study was calculated as shown in Note 14 of the GVEA table. Approximately 85% of the power used by Fort Greely was generated at Fort Wainwright and wheeled to Fort Greely. The remaining 15% was purchased directly from GVEA. The average yearly energy cost was calculated by adding the two energy costs, each weighted by their respective percentages listed above.

The cost of power generated at Fort Wainwright and wheeled to Fort Greely was determined by multiplying the cost of generation at Fort Wainwright (\$0.06/kWh) by the energy wheeled to Fort Greely (13,814,340 kWh) and adding to it the wheeling charge (17.64% of the GS-2 Rate Schedule) times the energy wheeled to Fort Greely. The cost of GVEA power was determined by taking the total charges from GVEA (\$528,806), subtracting their wheeling charges (\$185,347), and dividing the difference by the total energy purchased from GVEA (2,503,020 kWh). This incorporates the demand charges into the energy charges over the entire year for convenience.

Based upon the calculations above, the average yearly energy cost for Fort Greely is \$0.0832 per kWh.

5.5.2 Economic Life and Discount Factor

The recommended economic life chosen for this project was 20 years based on Type 8, Electrical Energy Systems, on the Energy Conservation Project Types sheet in Appendix K.

The discount factor chosen was 14.47 from the "Industrial (Elec)" column and "N=20" row of Table Ba-4, the "FEMP UPV* Discount Factors adjusted for fuel price escalation, by end-use and fuel type" table in Appendix K. This table is for Census Region 4 which includes Alaska, and the DOE Discount Rate used was 4.1 percent as stated on the table.

5.5.3 Estimated Energy Savings

The estimated energy savings were calculated by subtracting the average line losses determined in the Case 4 Load Flow Analysis from the average line losses determined in

the Case 3 Load Flow Analysis. In order to convert the peak power (kW) losses on the system to average annual energy (kWh) losses, the peak system losses were multiplied by the system load factor and the number of hours per year.

The average annual energy saved per year by converting the electrical distribution system from 2400 V to 4160 V is 16,727 kWh. Refer to the "Estimated Energy Savings" sheets in Appendix K.

5.5.4 LCCA

The standard COE LCCA was prepared using the numbers defined above. An additional 5.5% for supervision and inspection overhead (SIOH) and 6.0% for design costs were added to the total construction costs in the LCCA. This final sum represents the total investment required to upgrade the electrical distribution system from a 2400 V, ungrounded delta to a 4160 V grounded wye. The total investment is \$796,191.

The energy savings in dollars per year is \$1,392. This number is calculated by multiplying the average annual energy saved per year at the base by the average yearly energy cost. The number is multiplied by the uniform present value (UPV) discount factor, which represents the total energy savings in dollars over the twenty year life of the project, reflected into the first year. This number calculates to \$20,138.

A summary of the LCCA is shown in Table 5-2 below.

Table 5-2. LCCA Results

Description	Reduced System
Annual Energy Savings (kWh)	16,727
Annual Cost Savings (\$)	1,392
Investment Cost (\$)	796,191
Simple Payback (yrs)	572.1
SIR	0.03

There are no discernible non-energy savings in this project. The age and voltage (2400 V) of most of the existing equipment that will be replaced renders the salvage value negligible. Likewise, there is no public utility rebate for the improvements under consideration in this report.

The a SIR for this project is 0.03. Since this value is less than 1.25, the project does not qualify for implementation under the ECIP Program.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 LCCA SUMMARY

To qualify for government funding, ECOs must have a discounted Savings-to-Investment Ratio (SIR) greater than 1.25 and a simple payback less than 10 years. A project with an investment cost greater than \$300,000 will qualify for ECIP funding. Projects with investment costs less than \$300,000 will qualify for the Federal Energy Management Program (FEMP). Table 6-1 below summarizes the results of the LCCA.

Table 6-1. LCCA Results

Description	Upgrade Electrical Distribution System	
	Existing System	Reduced System
Annual Energy Savings (kWh)	222,330	16,727
Annual Cost Savings (\$)	18,498	1,392
Investment Cost (\$)	1,108,832	796,191
Simple Payback (yrs)	59.9	572.1
SIR	0.24	0.03

6.2 CONCLUSIONS

The conclusions discussed below are based on the results of the LCCAs performed in this study. Other relevant factors are also discussed, however, which should be considered before making a final decision.

6.2.1 Existing System (1995 to 1997)

With an SIR of 0.24, upgrading the existing electric distribution system from 2400 V to 4160 V is clearly unfeasible based upon energy savings alone. The high construction cost to implement the voltage upgrade and the low cost of power at Fort Greely both contribute to the inability to justify the conversion.

Working backwards from the results above, the average yearly cost of electricity would have to be at least \$0.43 per kWh at the present construction cost, or the construction cost would have to be less than \$193,000 at the present average yearly cost of electricity, in order to achieve an SIR of 1.25 or higher. It is EMC's opinion that neither of those numbers will ever be possible.

While upgrading the system voltage from 2400 V to 4160 V will not reduce the system losses enough to justify the construction costs, the conversion from an ungrounded system to a grounded system will dramatically enhance the safety and reliability of the overhead distribution system. With the ungrounded system presently in place, it is unlikely that a ground fault on a feeder will trip the feeders protective relay at Building 606 and take the feeder out of service until the fault can be removed. Approximately 85% of the faults that occur on an overhead distribution system are single-line-to-ground faults, simply referred to as ground faults.

Ground faults can be caused by tree limbs dropping onto the lines under the weight of a snowfall, or an automobile skidding into a pole and knocking it to the ground. The tree limb will lay across the lines or the lines will lay on the ground for an indefinite period of time. Eventually, someone reports the incident before the circuit is cleared by a lineman who must manually open the feeder breaker. In populated areas, not only will many people be without electricity while the line is down, but a line laying on the ground is extremely dangerous to anyone who comes into contact with it. In unpopulated areas, it could take several hours to find the downed line.

In addition, the ground fault acts as the system ground point. The ground fault current that flows through the line is the capacitive charging current of the system, generally only a few amps. If the ground fault is intermittent or allowed to continue, the entire system could be subjected to severe overvoltages which can be as high as six or eight times the phase voltage. The overvoltages are a result of the repetitive charging of the system capacitance or the resonance between the system capacitance and inductance. These overvoltages can puncture insulation and result in additional ground faults. Once the second ground fault occurs, a line-to-line fault occurs, usually arcing, with a current magnitude large enough to damage equipment. But this still may not be large enough to trip the overcurrent protective devices. Ungrounded systems are not standard practice for modern overhead distribution systems.

One final note, the protective relays on Feeder 9 will never see a ground fault on the 7200 V portion of the feeder because of the Δ - Δ step-up transformers at Building 606 and the Richardson Substation. Because of the remote location of this feeder, a line could be down and unmanned facilities without power for a long period of time before the outage is recognized.

6.2.2 Reduced System (Post 2001)

With an SIR of 0.03, upgrading the reduced electric distribution system from 2400 V to 4160 V is unjustified based upon energy savings alone. As with the existing system, the high construction cost to implement the voltage upgrade and the low cost of power at Fort Greely both contribute to the inability to justify the conversion. Even with generators 1, 2, and 3 laid away the SIR is not significantly improved.

It's not surprising that the reduced system looks even worse than the existing system because approximately 80% of the load has been eliminated. The system losses are equal to I^2R where I is the line or feeder load (current) and R is the line resistance in ohms. The system losses are much more dependent upon the line current because of its squared characteristic than the line resistance which is linearly proportional. Consequently, even though only 25% of the lines have been eliminated, the 80% reduction in load current has the predominant impact on system losses.

The average yearly cost of electricity would have to be greater and the construction cost lower than those defined above for the existing system. It is EMC's opinion that it will be almost impossible to justify upgrading the reduced system to 4160 V based upon energy savings alone. However, a case can be made for upgrading the system voltage based upon safety and reliability as described for the existing system above. Everything stated above with regard to safety and reliability for the existing system is also true for the reduced system.

6.3 RECOMMENDATIONS

EMC recommends that the Fort Greely electrical distribution system not be upgraded from an ungrounded 2400 V system to a grounded 4160 V system at this time. EMC further believes that it will always be difficult to justify this project based upon energy savings and economic considerations. With the continuing consolidation of electric utilities and open transmission access imminent, expectations are that electric rates will decrease over the long term. On the other hand, construction and equipment costs are expected to continue increasing at 3-5% a year for the near term, at least. None of this bodes well for the economic feasibility of this project in the future.

An upgrade to the electrical distribution system to a grounded, 4160 V system is justifiable on the basis of safety and reliability. An ungrounded distribution system is inappropriate at this site. At the very least, ground fault detection should be implemented as determined in previous studies.

APPENDIX A

Scope of Work and Confirmation Notices



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 898
ANCHORAGE, ALASKA 99506-0898

AUG 14 1995

Contract Support Group

SUBJECT: Contract No. DACA01-94-D-0033, Indefinite Delivery Architect-Engineer Contract for Energy Engineering Analysis Program (EEAP), North, West, and Midwest Regions

Mr. Dennis Jones
EMC Engineers
2750 South Wadsworth Boulevard
Suite C-200
Denver, Colorado 80227-3400

Dear Mr. Jones:

The following documents are enclosed for your use to prepare a fee proposal for the work in item a:

- a. A Scope of Work for a modification to Delivery Order No. 0003 entitled, "Limited Energy Study (Power Distribution), Fort Greely, Alaska," is as follows: Add the energy efficiency study for steam, water, and sanitary sewer for the buildings (see active building list) that are to remain in active status.
- b. Fee proposal forms.

Please furnish a fee proposal (forms enclosed) for this work by August 24, 1995, to the attention of my Contract Support Group. Hourly labor rates and overhead rates are established in the basic contract.

Please contact Mr. Randy Jacobs, Negotiator, at 907/753-5639 if you have any questions.

Sincerely,

Trillis B. Enders
Alternate Contracting
Officer's Representative

Enclosures

SCOPE OF WORK
ENERGY EFFICIENCY STUDY
FOR
FORT GREELY
ALASKA

Performed as part of the
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

GENERAL SCOPE OF WORK
CONTRACT NO. DACA85-94-C-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY
FORT GREELY, AK
performed as part of the
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

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1.0 BRIEF DESCRIPTION OF WORK: The Architect-Engineer (A/E) shall:

1.1. Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

1.2. Provide project documentation for recommended ECOs as detailed herein.

1.3. Prepare a comprehensive report to document all work performed, the results and all recommendations.

2.0 GENERAL:

2.1. This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in the DETAILED SCOPES OF WORK, Annexes A and D.

2.2. The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3. For the buildings, systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.

2.4. The study shall consider the use of all energy sources applicable to each building, system, or ECO.

2.5. The "Energy Conservation Investment Program (ECIP) Guidance", establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. A computer program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. This program is available commercially from the BLAST Support Office in Urbana, Illinois. The BLAST Support Office can be contacted at 1-800-842-5278. The latest version of the program should be used. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval prior to use.

2.6 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.

3.0 PROJECT MANAGEMENT:

3.1. Project Managers:

3.1.1 Project Manager: The A/E shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. This designated individual shall be responsible for coordination of work required under this contract.

3.1.2 Design Manager: The Contracting Officer will designate a design manager to serve as the Government's point of contact and liaison for all work required under this contract.

3.2. Installation Assistance: The Director of Public Works or authorized representative will designate an individual to assist the A/E in obtaining information and establishing contacts necessary to accomplish the work required under this contract.

3.3. Public Disclosures: The A/E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4. Meetings: Meetings will be scheduled whenever requested by the A/E or the Design Manager for the resolution of questions or problems encountered in the performance of the work. The A/E's project manager and the design manager shall be required to attend and participate in all meetings pertinent to the work required under this contract. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5. Site Visits, Inspections, and Investigations: The A/E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6. Conferences and Confirmation Notices:

3.6.1. The A/E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A/E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the records.

3.6.2. The A/E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.6.3. A review conference will be scheduled approximately 28 days after submittals. Review comments will be provided at this conference. These comments will become part of the conference minutes forwarded to the A-E and annotated with conference action. Review comments provided to the A-E will not necessarily show coordination requirements with other parts of the

submittal. The A-E shall incorporate the review comments into each part of the submittal as necessary.

3.7. Interview: The A/E shall conduct entry and exit interviews with the Director of Public Works or designated representative before starting work at the installation and after completion of the field work. The Design Manager shall schedule the interviews at least one week in advance and shall be in attendance.

3.7.1. Entry: The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

- a. Schedules
- b. Names of energy analysts who will be conducting the site survey.
- c. Proposed working hours.
- d. Support requirements from the Directorate of Public Works.

3.7.2. Exit: The exit interview shall be conducted when the field work is complete and briefly describe the items surveyed and probable areas of energy conservation.

4.0 SERVICES AND MATERIALS: All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5.0 PROJECT DOCUMENTATION: All energy conservation opportunities which the A/E has considered shall be included in one of the following categories and presented in the report as such:

5.1. ECIP Projects: To qualify as an ECIP Project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than \$300,000. The overall project and each discrete part of the project shall have an SIR greater than 1.25. Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Saving to Investment Ratio (SIR). Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs.

5.2. NON-ECIP Projects: Projects which do not meet ECIP criteria, but which have an SIR greater than 1.25 shall be documented and ranked in order of highest to lowest SIR. Projects or ECOs shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out; a description of the work to be accomplished; backup data for the LCCA, ie; energy savings calculations and cost estimate(s); and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account there synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than \$300,000.00 and a simple payback period of ten to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

b. Low Cost/No Cost Projects. These are projects which the Directorate of Public Works (DPW) can perform using its resources. Documentation shall be as required by DPW.

5.3. Nonfeasible ECOs: All ECOs which the A/E has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6.0 DETAILED SCOPE OF WORK: The Detailed Scope of Work is contained in Annex A and Annex D.

7.0 WORK TO BE ACCOMPLISHED:

7.1. Review Previous Studies: Not Used.

7.2. Perform a Limited Site Survey: The A/E shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. The A/E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrate prior to its use.

7.3. Reevaluate Selected Projects: Not Used.

7.4. Evaluate Selected ECOs: As described in Detailed Scope of Work.

7.5. Combine ECOs Into Recommended Projects: At the interim review conference, the A/E will be provided direction of the packaging or the combining of ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. Some projects may be a combination of several ECO's, and others may contain only one.

7.6. Submittals: The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included.

7.6.1. Interim Submittal: An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound separately in a

standard three-ring binder. The A/E shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly.

7.6.2. Final Submittal: The A/E shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The A/E shall submit the Scope of Work for the study and any modifications to the scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

- a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).
- b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.
- c. Documentation for the recommended projects (includes LCCA Summary Sheets).
- d. Appendices to include as a minimum:
 - 1) Energy cost development and backup data
 - 2) Detailed calculations
 - 3) Cost estimates
 - 4) Computer printouts (where applicable)
 - 5) Scope of Work

7.7 Presentation: The A/E shall give a formal presentation of the interim submittal to the installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. The presentation will be conducted the same day as the review conference.

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ANNEX A

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (POWER DISTRIBUTION)
FORT GREELY, ALASKA

1.0 General Information:

1.1 The Architect-Engineer (A-E) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 This SOW is organized as follows:

Paragraph TOPIC:

- 1.0 General Information
- 2.0 Project Criteria
- 3.0 Cost and Scope Limitations
- 4.0 Delivery Schedule
- 5.0 Architect Engineer Services
- 6.0 Initiation Of Work
- 7.0 Government Review
- 8.0 Travel
- 9.0 Submittals

1.1.3 Project Description: The AE will be required to conduct a limited site survey, evaluate energy savings, construction costs, and the cost to savings ratio associated with converting the existing power distribution system from 2400 volts, 3-wire ungrounded Delta to a 4-wire system. The AE shall investigate the existing system, and prepare a comprehensive report documenting all work performed, the results and recommendations. See Annex D for list of buildings and linear feet of utilities to remain active after base realignment.

The investigation is to include but not limited to: Insulators, crossarm condition, pole condition, wire size, wire material, wire connectors and transformers. Begin at the output of the Golden Valley Electric Association Transformed into the power plant and out through the distribution system. There are approximately 35 miles of overhead distribution system. Single line drawings of the distribution system resulting from a recent short circuit study and feeder and transformer data are at Enclosure 1.

1.1.4 Point of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 Project Criteria:

2.1 Government Furnished Materials and Equipment:

- a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.
- b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.
- c. TM5-785, Engineer Weather Data
- d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.
- e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.
- f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2.1 Review Previous Studies: Previous EEAP studies do not cover power distribution.

3.0 Cost and Scope Limitations:

3.1 Cost Limitation: The construction cost limitation for this project is undefined. The AE will be responsible for developing the cost based upon the scope constraints for this project.

3.2 Cost Estimate:

3.1.2 Cost Estimate Format: Cost estimates shall be prepared using the latest version of Micro Computer Aided Cost Engineering System (MCACES)-GOLD, Version 5.20J or greater, with the appropriate labor equipment and material data bases. MCACES-GOLD will be provided to the A-E by the Cost Engineering Branch of the Alaska District Corps of Engineers at no cost. Upon completion of the contract, the A-E will return all material to the Government. The Alaska District is using a Standardized Work Breakdown Structure (WBS) for all military and civil work cost estimates. Corps format for cost estimates will be made available for use on other cost estimate requirements.

4.0 Delivery Schedule: The work, other related data, and services required in accordance with the contract shall be accomplished within the limitation of projects scope. The schedule for delivery of data to the Contracting Officer is in calendar days. Calendar days for each requirement extend from the date of the Notice to Proceed (NTP) or approval for each item, except as otherwise noted.

	<u>Item</u>	<u>Schedule</u>	<u>DeliveryReview/Conference Time/Location</u>
(a)	Start Project: Interviews and Site Survey	30 days following NTP	Not Required
(b)	Interim Submittal	90 days following NTP	28 days / Post
(c)	Final Submittal	21 days following Interim Rev. Conf.	Not required

5.0 Architect-Engineer Services:

5.1 Interim Submittal: The interim submittal shall fulfill the requirements of the paragraph 7.6.1 of the General Scope of Work.

5.2 Final Submittal: The final submittal shall fulfill the requirements of paragraph of the General Scope of Work. The A-E shall incorporate all interim review conference comments. The Government may back-check all documents which comprise this submittal. The documents, if found incomplete, shall be returned to the A-E for further work which shall be performed at no additional cost to the Government.

6.0 Initiation of Work:

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

7.0 Government Review:

7.1 Value Engineering: Not Used.

7.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

8.0 Travel:

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

9.0 Submittals:

All submittals shall be received at the Alaska District Engineer Offices, Design Management Section, Military Technical Engineering Branch in accordance with the design schedule in Section 4.0 above.

9.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

9.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY

EXECUTIVE SUMMARIES REPORTS CORRESPONDENCE FIELD NOTES

Commander, 6th Infantry Division (Light)
ATTN: APVR-FG-PW (Murphy)
P.O. Box 1289, Delta Junction, AK 99737

7 7 1 1*

Commander, 6th Infantry Division (Light)
ATTN: APVR-PW-O (Berg)
Building 730, Fort Richardson, AK 99505-5500

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Commander, USAED, Mobile
ATTN: CESAM-EN-DM (Battaglia)
P.O. Box 2288, Mobile, AL 36628-0001

1 1 1 -

Commander, USAED, Alaska
ATTN: CENPA-EN-TE-DM (Piening)
P.O. Box 898, Anchorage, AK 99506-0898

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Commander, USAED, Alaska
ATTN: CENPA-CO-FR (Shuman)
P.O. Box 35066, Fort Wainwright, AK 99703-0066

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Commander, North Pacific Division
ATTN: CENPD-PE-TE (Pinkham)
P.O. Box 2870, Portland, OR 97208-2870

1 1 - -

Commander, US Army Logistics Evaluation Agency
ATTN: LOEA-PL (Mr. Keath)
New Cumberland Army Depot
New Cumberland, PA 17070-5007

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Commander, US Army Corps of Engineers
ATTN: CEMP-ET (Mr. Gentil)
20 Massachusetts Avenue, NW
Washington, DC 20314-1000

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* Field Notes Submitted in final form at interim submittal

PIENING\re\1600\ARMY\FTW141\DAVE
4 Aug 94

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.
2. Building Data (types, number of similar buildings, sizes, etc.)
3. Present Energy Consumption of Buildings or Systems Studied.

- Total Annual Energy Used.
- Site Energy Consumption.

Electricity - KWH, Dollars, BTU
Fuel Oil - GALS, Dollars, BTU
Natural Gas - THERMS, Dollars, BTU
Propane - GALS, Dollars, BTU
Other - QTY, Dollars, BTU

4. Energy Conservation Analysis.

- ECOs Investigated.
- ECOs Recommended.
- ECOs Rejected. (Provide economics or reasons).
- ECIP Projects Developed. (Provide list) *
- Non-ECIP Projects Developed. (Provide list) *
- Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

5. Energy and Cost Savings.

- Total Potential Energy and Cost Savings resulting from recommended projects in MBTU/yr and \$K/yr.
- Percentage of Energy Conserved
- Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

- a. In title block clearly identify projects as "ECIP."
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
- d. List references, and assumption, and provide calculations to support dollar and energy savings, and indicate any added costs.
 - (1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
 - (2) Identify weather data source.
 - (3) Identify infiltration assumptions before and after improvements.
 - (4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
- e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operations and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.
- f. AN ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.
- g. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement

attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

h. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

i. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.

j. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

k. Any requirements required by ECIP guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

l. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

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ANNEX D

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (STEAM, WATER, SANITARY SEWER)
FORT GREELY, ALASKA

1.0 GENERAL INFORMATION

1.1 The Architect-Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 This SOW is organized as follows:

Paragraph TOPIC:

- 1.0 General Information
- 2.0 Project Criteria
- 3.0 Initiation Of Work
- 4.0 Government Review
- 5.0 Travel
- 6.0 Schedule and Submittal Requirements
- 7.0 Payment Schedule

1.1.2 Project Description: The purpose of the Energy Efficiency Study is to identify modifications necessary to provide the most energy efficient configuration of utilities to serve the designated active buildings at Fort Greely following implementation of the base realignment plan. Currently the buildings at Fort Greely are served by a central electric distribution system, central steam system, central potable water system, and a central sewer system. Much of these central systems are near the end of their useful lives. With the abandoning of most buildings, the existing utilities will likely be grossly over sized and operate with poor energy efficiency and high maintenance costs. This study is to evaluate the following configurations for each utility:

- a. Modification of central systems to serve remaining designated active buildings.
- b. Installation of separate utilities to serve each designated active building or group of buildings.

The contractor will be required to evaluate the central steam, potable water, and sanitary sewer systems and determine if the systems are adequate to serve the buildings and associated utilidors designated in the Fort Greely Realignment Plan (see Active Building List below) that are to remain active. In evaluating the present system, the contractor shall complete a energy survey and provide a plan that will provide the greatest energy efficiency.

There are currently 231 buildings located on Fort Greely, consisting of 1,699,787 sq. ft. of space. the majority of which will be "laid-away" under the Layaway Program for disposition or eventual demolition. Of these 231 buildings, the following have been identified for retention to support the residual force to be left at Fort Greely. The following tables are from a draft of the IMPLEMENTATION PLAN FOR REALIGNMENT OF FORT GREELY as provided by Mr. Mike Murphy, Dept. of Public Works, Ft. Greely, Alaska:

Permanent Active Facility List as of 25 JUL 95

Bldg No.	Description	Location	Size (SF)
110	POL Monitoring	North Post	382
501	HQ	Cantonment	19,095
504	Fire Station	Cantonment	6,192
605	Consolidated PW	Cantonment	24,915
606	Central Heat Plant	Cantonment	30,334
607	Heat Plant Annex	Cantonment	999
615	Roads and Grounds	Cantonment	17,351
617	POL Operation	Cantonment	448
618	POL Operation	Cantonment	621
633	Sewage Treatment	Cantonment	2,784
638	Sewage Lagoon	Cantonment	742
639	Contact Chamber	Cantonment	696
820	Unacc Pers Hsg	Cantonment	16,175
821	Unacc Pers Hsg	Cantonment	16,175
503	Gym w/o Pool	Cantonment	22,430
725	State School	Cantonment	0 (Non-Army)
1928 & 1930	CRTA Complex	Bolio Lake	35,061
2013, 2019, 2026	NWTC Complex	Black Rapids	39,218
1600, 1605, 1606	Range	Texas Range	6,211
1343, 1350, 1352	Range	Beales Range	4,968
1419	Range	Mississippi Range	960
		TOTAL	245,937

Real Property Utilities

Category	Before	After
Overhead Electric	31.2 Miles	23.1 Miles
Underground Electric	10.7 Miles	3.4 Miles
Steam/Condensate Lines	57,000 LF	5,700 LF
Water Lines	40,000 LF	5,700 LF
Sewer Lines	45,000 LF	7,700 LF
Utilidors	17,600 LF	5,550 LF

1.1.3 Points of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 PROJECT CRITERIA

2.1 Government Furnished Materials and Equipment:

- a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.
- b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.
- c. TM5-785, Engineer Weather Data
- d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.
- e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.
- f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2 Field Investigation

Conduct a survey of the existing central utilities and the buildings to remain under the Fort Greely realignment plan. Data collected for each utility should include, but not be limited to the following:

- a. Present condition and expected life of the existing central distribution systems.
- b. Modifications necessary to restrict central utility service only to designated active building and facilities.
- c. Data necessary to determine costs associated with continued operation of central utility systems including modification costs, energy costs, and operating and maintenance (O & M) costs.
- d. Data necessary to determine utility capacity requirements and energy consumption of each designated active building.
- e. Modifications necessary to install separate utilities in individual buildings or groups of buildings.

2.3 Analysis

- a. Operation of existing central systems with only those essential modifications required to serve the remaining designated active buildings. This option will serve as the baseline for Energy Conservation Opportunity (ECO) analysis.
- b. ECO 1: Operation of existing central systems optimized to serve the remaining designated active buildings.
- c. ECO 2: Installation of separate utilities (where practical) to serve each designated active building or group of buildings.

The A/E should identify the logical configuration of each utility for each of the above options and perform life cycle cost analysis (LCCA) including capital costs of required modifications, energy costs, and O & M costs.

Economic analysis should follow the criteria for the "Energy Conservation Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 Jan 1994.

Computer modeling will be used to determine the annual energy costs for typical buildings. The results of these calculations may be applied to buildings which are similar to the typical buildings. To be considered similar, a building must have the same type of occupancy schedule, the same type of HVAC system, and the same type of construction. Modeling will be performed using a professionally recognized and proven computer program of programs that integrate architectural features with air-conditioning, heating, lighting,, and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The simulation programs acceptable for use in this study are listed below. Any substitutes must be submitted and approved by the COR.

- A. Building Loads and System Thermodynamics (BLAST).
- B. DOE 2.1d
- C. Carrier E20 of Hourly Analysis Program (HAP)
- D. Trane Air-Conditioning Economics (TRACE).
- E. Beacon

3.0 INITIATION OF WORK

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

4.0 GOVERNMENT REVIEW:

4.1 Value Engineering: Not Used.

4.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

5.0 TRAVEL

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

6.0 SCHEDULE AND SUBMITTAL REQUIREMENTS

<u>Submittal</u>	<u>Schedule</u>
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final submittal
Final Report	30 days from review conference

6.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

6.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY

EXECUTIVE SUMMARIES REPORTS CORRESPONDENCE FIELD NOTES

Commander, 6th Infantry Division (Light)
ATTN: APVR-FG-PW (Murphy)
P.O. Box 1289, Delta Junction, AK 99737

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Commander, 6th Infantry Division (Light)
ATTN: APVR-PW-O (Berg)
Building 730, Fort Richardson, AK 99505-5500

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Commander, USAED, Mobile
ATTN: CESAM-EN-DM (Battaglia)
P.O. Box 2288, Mobile, AL 36628-0001

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Commander, USAED, Alaska
ATTN: CENPA-EN-TE-DM (Piening)
P.O. Box 898, Anchorage, AK 99506-0898

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Commander, USAED, Alaska
ATTN: CENPA-CO-FR (Shuman)
P.O. Box 35066, Fort Wainwright, AK 99703-0066

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Commander, North Pacific Division
ATTN: CENPD-PE-TE (Pinkham)
P.O. Box 2870, Portland, OR 97208-2870

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Commander, US Army Logistics Evaluation Agency
ATTN: LOEA-PL (Mr. Keath)
New Cumberland Army Depot
New Cumberland, PA 17070-5007

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Commander, US Army Corps of Engineers
ATTN: CEMP-ET (Mr. Gentil)
20 Massachusetts Avenue, NW
Washington, DC 20314-1000

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* Field Notes submitted in Final Form at interim submittal

PIENING\relx1600\ARMY\FTG058\ANNEXD.FTG

2 Aug 95

Date_____19____

 Original

Subject: _____ Location: _____
 Estimated by: _____ Sheets of Drawing Required: _____

DO/MOD NO:

REMARKS:

[illegible]

§ _____

\$ _____

\$

§ _____

§ _____

§ _____

SUBTOTAL

\$

PER DAY \$ _____

PER DAY \$ _____

PER ROUND TRIP \$ _____

PER ROUND TRIP \$ _____

(round to the nearest dollar) TOTAL FEE

^/E SIGNATURE _____ DATE _____

TITLE _____



PROFIT EVALUATION SHEET
Weighted Guideline Method
RFP/Contract No. _____
Modification/DO No. _____

<u>Factor</u>	<u>Rate</u>	<u>Weight</u>	<u>Value</u>
Degree of Risk	25	_____	_____
Relative Difficulty of Work	20	_____	_____
Size of Job	15	_____	_____
Period of Performance	20	_____	_____
Contractor's Investment	5	_____	_____
Assistance by Government	5	_____	_____
Subcontracting	10	_____	_____
TOTAL	100%	PROFIT	_____

Explanation of Weight Assigned--

Degree of Risk: _____

Relative Difficulty of Work: _____

Size of Job: _____

Period of Performance: _____

Contractor's Investment: _____

Assistance by Government: _____

Subcontracting: _____

Based on the circumstances of the procurement action, each of the above factors shall be weighted from .07 to .15 as indicated below. "Value" shall be obtained by multiplying the rate by the weight. The Value column when totaled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement.

Degree of Risk: Where the work involves no risk or the degree of risk is very small, the weighting should be .07; as the degree of risk increases, the weighting should be increased up to a maximum of .15. For construction work, lump sum items shall generally have a higher weight than unit price items; other things to consider include the nature of the work and where it is to be performed, etc. AE contracts with options shall generally have a higher weighted value than contracts without options; other things to consider include nature of design, responsibility for design, amount of principal time required, etc. For all types of contracts consider the portion of the work to be done by subcontractors, amount and type of labor included in costs, whether the negotiation is before or after performance of the work, etc. Modifications settled before the fact have much greater risk than those settled after the fact. A weight of .07 is appropriate for after the fact equitable adjustments and/or settlements.

Relative Difficulty of Design: If the design is most difficult and complex the weighting should be .15 and should be proportionately reduced to .07 on the simplest of jobs. This factor is tied-in to some extent with the degree of risk. Some things to consider are: the nature of the design, by whom it is to be done, i.e. subcontractor, consultants, what is the schedule, etc., and it is rehab or new work.

Size of Job: All work and fees not in excess of \$50,000 shall be weighted at .15. Work estimated between \$50,000 and \$500,000 shall be proportionately weighted from .15 to .09. Work from \$500,000 to \$1,000,000 shall be proportionately weighted from .09 to .07. Work in excess of \$1,000,000 shall be weighted at .07. It should be noted that control of fixed expenses generally improves with increased job magnitude.

Period of Performance: Work in excess of 24 months (180 days actual time) are to be weighted at .15. Work of lesser duration shall be proportionately weighted from .07 to .15 for work not exceeding 60 days.

Contractor's Investment: To be weighted from .07 to .15 on the basis of below average, average, and above average. Things to consider include amount of subcontracting, Government-furnished property or data such as surveys, soil tests, method of making progress payments, etc.

Assistance by Government: To be weighted from .15 to .07 on the basis of average to above average. For construction consider use of Government-owned property, equipment and facilities, expediting assistance, etc. For AEs consider use of as-built drawings, Government surveys, soil exploration, and foundation recommendations.

Subcontracting: To be weighted inversely proportional to the amount of subcontracting. Where 80% or more of the work is to be subcontracting use .07. The weighting should be increased proportionately to .15 where all the work is performed by the contractor's own forces.



2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 1

EMC #1406.003

DATE: 11 September 1995

PLACED TO: Dennis Jones / Fred Jones
RECEIVED FM: Dave Piening / Gary Creviston
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES: Fred Jones,
PREPARED BY: E M C Engineers, Inc.

TIME & DATE: 10:30 MST
OF TELECON: 11 September 1995

SUBJECT: Clarifications to SOW dated 1 August 1995

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit a combined report that includes the Energy Efficiency Studies for the Power, Steam, Water, and Sanitary Sewer Distribution Systems.
2. EMC will proceed with the study using the list of buildings to remain active as provided in the SOW dated 1 August 1995. If this list is changed significantly before the completion of the report and the results of the study are impacted, a change in the SOW will be issued.
3. EMC will use the distribution list from the original SOW dated 1 August 1994. Commander Pinkham will receive one copy of the report.
4. EMC will provide 23 copies each of the Pre-Final and Final reports.
5. EMC will address the fact that the base will not begin downsizing until 1997 and the downsizing will continue through 2000. The interim period between 1995 and 1997 will be discussed in the power distribution section of the study.

Confirmation Notice No. 1
11 September 1995
Page 2 of 2

6. EMC will include the cost of having GVEA provide electric service to the buildings that will remain after the downsizing.
7. The submittal schedule will be the same as shown in Section 6.0, Page D-4 of the SOW dated 1 August 1995. For the sake of clarity, that schedule is as follows:

<u>Submittal</u>	<u>Schedule</u>
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final Submittal
Final Report	30 days from review conference

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.



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Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 2

EMC #1406.003

DATE: 12 September 1995

PLACED TO: Dennis Jones
RECEIVED FM: Dave Piening
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES: Fred Jones,
PREPARED BY: E M C Engineers, Inc.

TIME & DATE: 16:45 MST
OF TELECON: 12 September 1995

SUBJECT: Clarifications to Confirmation Notice No. 1

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit two separate reports for the Energy Efficiency Study for Fort Greely Alaska. One report will be entitled "Energy Efficiency Study (Power Distribution), Fort Greely, Alaska. The other report will be entitled "Energy Efficiency Study (Steam, Water, Sanitary Sewer), Fort Greely, Alaska.

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
Bill Center
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.



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CONFIRMATION NOTICE

Confirmation Notice No. 3

EMC #1406.003

DATE: 8 December 1995

PLACED TO: Dave Piening
RECEIVED FM: Fred Jones
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES: Fred Jones,
PREPARED BY: E M C Engineers, Inc.

TIME & DATE: Approximately 11:00 MST
OF TELECON: 6 December 1995

SUBJECT: GVEA Letter

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. The letter to GVEA prepared by EMC for the purpose of ascertaining their interest in supplying electricity directly to the remaining buildings at Fort Greely after the realignment, has been forwarded to the appropriate contracts people for disposition. It is likely that an answer on this issue will not be back before the power distribution report submittal is due. If that is the case, the issue will be mentioned in the report only to the extent that it is another avenue that is being investigated.
2. It has not been determined yet whether the review meeting will be held in Delta Junction or Anchorage. Will confirm later.

/oic

Action Required: Issue Notice to Proceed.

cc: Fred Jones
Dennis Jones

Confirmation Notice No. 3
8 December 1995
Page 2 of 2

Doug Gray
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

APPENDIX B

Field Survey Notes

Recorded 8/25 - 9/1 of 1995 in Alaska 1/9

Tape recorded notes from Ft. Greely, AK

I. CRTA - Bolio Lake - Bldg 1928

overhead service to east (back of building)

A. far south end 3 ϕ service drop
7200 V Δ - 150 KVA, 3 ϕ (1 ϕ transformers)

B. behind Bldg 1928

7200 V Δ - 208/120 Y $\frac{1}{2}$, 500 KVA, pad mount

4.5% Z @ 500 KVA, 65°C Rise, 9/89

S.N. 890133-A1, OA, 3 ϕ , 60 cy

Alum. windings, NLTC -

A 7560 +5%

B 7380 +2½%

C 7200 0

D 7020 -2½%

E 6840 -5%

non PCB oil

± PSI 7 170 Gal-oil - 1275 lbs

~~core~~ core - 1730 lbs - coil ~~XXXXXX~~

Tank & Fittings - 1450 lbs

4455 lbs total

Xo on Secondary

Secondary cable size -

~~XXXXXX~~

3 [(4-750MCM, CU, XHHW) 4" C]

C far north end 3-50 KVA - 1 ϕ transformers

D 120/208, 1600 A main switch gear
3 ϕ , 4 wire at Balio Jakes (CRTA)
Plant code 49 main bldg

Cat No - 0894929-A

Drawing No \rightarrow

Sq. D QED Power Style Switchboard

2000 A frame MCB 40°C Series 4

PAF 2036 240 - 65K AIC

SQ. D 480 - 50K AIC

600 - 42K AIC

IEC 157-1 PI - 50 Hz

Sq D certified 50K 380/220

50K 415/240

Type PAL 600 V. for 1 ϕ use outside ~~panels~~ only

Cat # PAM 02 PA, PH, PC, PE circuit breakers
Breaker and switches use

feeds a distribution panelboard section.
panelboard feeds MCC & lighting Panels

couldn't get into padmount transformer
primary.

The line behind the facilities continues
on north to ranges.

3/9

- E. Ranges are shooting ranges
O.H. lines to ranges & OP's the same
Single 8' crossarm w/ridge pin
design for the most part
- F. Tap at Bolio Lake line to Texas Range &
Air Switch - Load Break Miss. Rang.
AB Chance, Type D
Cat. # CD7HE1CL
110 KV BIL, 15KV Class
600 A Continuous
40 KA Momentary
ID# 90320
This is the type of sectionalizer switch they use
- G. OPTA - Single Phase
for heaters & lights mostly
- H. Texas Range - about the same
as Mississippi Range
This is the end of the feeder line.
- I. 2400 to 7200 step up transformers at
the Power Plant - (3) 1 ϕ , oil filled,
500 KVA each, 7200/12470 - 2400/4160
 $Z = 4.55\%$ A } 55°C Temp Rise
 $Z = 4.60\%$ B } Westinghouse
 $Z = 4.55\%$ C }
NLTC, Class OA, Substructure Polarity

4/9

Serial No's

C - 6407187
B - 6407186
A - 6407185

J. 2400-7200 Transformers @
Richardson Sub. (3) 1 ϕ G.E. Spira Core
~~440/27200~~

4.7% Z	8991102	200 KVA
4.7% Z	8991101	200 KVA
4.7% Z	8991100	200 KVA

2300 V rated

NLTC's Pos.

6930 1

6765 2

6600 3

6435 4

6270 5

Continuous 55°C Rise

Type H/S

Additive Polarity

Oil Circuit Breaker

Allis Chalmers Type OX-18
Ser No. 305756

600 A, 7.2 KV, 75 KV BIL

12/55 Manufacture

5/9

K. 7200 V. O.H. line out of Richardson Sub
is (3) #4 ACSR

1 ϕ tap toward Arkansas Range
is (2) #6 Solid Copper
2400 V insulators, 4' Arms
Poles falling over, need to be
replaced and also bad shape

L. 7200 V line to RD Complex down
the hill - poles in good shape
crossarms & insulators need to be
checked & replaced

M. Fiberglass arms O.H. to Georgia
Range - could go vertical.
check sag - 35' poles to the
ranges - pretty low for transformer
installation - secondary will be very
low

N. Chance Fiberglass Arms - narrow
profile - rating?

O. 7200 V line from front of base
on down to Bald Lake 35/2
35' is kind of low for secondary
and getting across ^{B-5} the highway

6/9

P. Standard O.H. Sizes

4/0 ACSR - around base where loads are heavier

#2 ACSR - on long runs where loads density is not quite so large

Q. Tap to Beales Range Complex recently taken out of service
#2 CH - 7200 V - 3p

R. Lampkin Range is abandoned

S. Line from Richardson Highway to Bolio Lake is believed to be 7200 V. glass insulators #2 ACSR & #2 ACSR both sides - poles, glass and crossarms are all in pretty good shape - only 20 years old from air-break switch at Richardson Highway to Bolio Lake.

T. Mention improved Operation & Maintenance procedures by going to a grounded Y from a Δ - try to put some monetary value on this to help justify it. Also address safety ^{B.P.} as a consideration.

7/9

- U. Most damage to insulators is due to damage by shot from shotguns - bird hunting.
- V. U.G. from Bald Fakes line to Condas should be rebuilt - it was buried too shallow and is heaved above the ground very often - it has been patched a lot. Should be replaced by O.H. if lead at Condas is still necessary and required. - patched as much as 30 times already.
- W. Because of the reduction in base load, you could probably reduce 9 feeders to 2 feeders.
- X. Line (7200) from air break switches to Mississippi Range was built by the Army - the crossarms are very low - it should be raised and the neutral put 36" - 40" down on the pole - insulators look like 5KV - small skirt - should be upgraded to 15KV class.
- Y. All O.H. on the base proper is 4/0 ACSR 8' crossarms - 2^{B7} phases on one side and

8/9

one phase on the other - the most efficient way to add the neutral is to put it on the side of the arm with only one phase on it presently. You will need an insulator only.

E. Approximately 15% of the insulators need to be replaced and approximately 5% of the crossarms.

AA EG 1 1250 KVA
2400 V, 3 ϕ
~~2400 V~~ Amps = 300.7
50°C Rise Stator
60°C Rise Rotor
1000 KW, 360 RPM
0.8 PF, 60 Hz
101 Amps - 125 Volts - Exciter
Ser. No. 3-S-9691
Elliott Co., Ridgeway, Pa

EG 2

Same as EG 1

Ser. No. 2-S-9691

What is rated voltage of armature - 2400 V.

EG 3

Same as EG 1

Ser No. B-S-9691

9/9

EG 4

1500 KVA
4160 V, 3 ϕ
217 Amps
60°C Rise Stator
60°C Rise Rotor
1250 KW, 360 RPM
0.8 PF, 60 Hz
125 Amps, 125 Volts - Exciter
Ser No 4-S-10915
Elliott Company
Ridgeway, PA
4160 Y
2400 Δ
connected Δ presently

EG 5

Same as EG 4
Ser No. 7-S-10915

AB Call Elliott get reactance information

$X_d'' = 26.4\%$ from power plant files

$X_d' =$

$X_s =$

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Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB _____
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Meeting - Kickoff - Ft. Greeley

<u>Name</u>	<u>Company</u> <u>Position</u>	<u>Phone No.</u>
BILL CENTER	EMC Engineers	404-642-1864
Hawley Zachy	Lineman	907-873-4484
LARRY Shetler	Lineman	907-873-4494
James Mellott	D. Revisor	807-873-4592
MIKE MURPHY MB	GENERAL ENGINEER	873-1132
DEAN Stumpe MB	Acting OPERATION + MNT	873-4589
MIKE MAJDOLAK		873-1145
THOMAS THETSEN	ENHAPP OP from DPW	873-4700
GEORGE PURSEY 606	CHAPP utl from DPW	873 4700
Fred Jones	EMC Engineers	303-988-2951

Notes: Friday Bldg 603 1/3
Kickoff Meeting 8-25-95 Public Works
10:00 AM - 11:30 AM Conference Room

1. 7200 V is ungr. Δ stepped up
from 2400 V, Δ , 3 ϕ

2. base is quite spread out
serve fed from 7200 V, Δ , 3 ϕ

3. some locations have prime power

Bolis Lake

Black Rapids Training Site

buildings closed will not be abandoned
city may pick up the buildings or
some of them

utilidors - underground utility tunnels

majority of overhead system is in good
condition

George Range need work

Aerial or underground

feeders to OP's needs to be reduced (underground)
Air Force wants to spend a chunk of money
to replace some power distribution.
some are metered ^{B-1} not read or out of calibration

realignment about 6 years out
 2001 - final alignment
 phased in between July 1997 and 2001

cannot completely lay away a facility
 here in Alaska - it will be destroyed
 in 2 years

break study into 2 time frames

1. near future - 1996 & 1997 - before
 base is reduced
2. distant future - 1997-2001 - while
 base is being reduced
3. after 2001 - after reduction complete

~78 vacant quarters
 337 total quarters

main switchgear 1953 generation
 Westinghouse & G.E. - air breakers
 Magneblast

upgrade to vacuum breakers?

GVEA is radial - 25 KV to base

Carpenter Ants - a pale problem
 no ice on leaves; just frost

the new stuff is 15KV glass
no tracking
no flashovers

go to new switch gear - vacuum to interrupt
faults safely - new sub. for gens.
5.5 MW of generators diesel

2 - 1250's

3 - 1000's

need keep at ranges

all buildings on list of 21 are
presently occupied

runway lights are GVEA through FAA

606 - heating plant - switchgear & gens

603 - Public Works Office

601 - Warehouse

663 - Billetting/Housing

801 - Transient Quarters 873-6227

Room # 227 Fred

Room # 220 Bill

X_d'' for 1000 KW & 1250 KW generators
is 26.4%

GVEA
758 Illinois St
Fairbanks, AK 99701

P.O. Box 71249
Fairbanks, AK 99707 } Send correspondence

Dave Johnson
New Service Coordinator
1-800-770-4832 EXT. 606
1-907-452-1151

Take Cushman St. from Airport Way
across the Chena River. It turns
into Lincoln St. GVEA is just
down the Street on the left.

Friday 9-1-95 - Public Works

1. O.H. distribution is unacceptable to GVEA as it is as Δ - going to 4160 Y makes the system more attractive to GVEA
2. Check with GVEA - find out if they would serve the base - how would they do it - would would they charge to do it.
3. Mike Mandulak 873-1145
Mike Murphy 873-1132
FAX 837-1384
Director of Public Works } fastest.
P.O. Box 1289 } mail.
Delta Junction, AK 99737 }

They always replace insulators & other equip.
with 15KV class when they do it.

Cedar poles get rot but bamboo
poles don't rot at the butt

look at (3) transformers that go
2400 Δ to 7200 Δ - find out

substation behind power plant
2400 \rightarrow 7200 for feeder 9
could use same work

Standardized to REA standards for
pole line design

typically run #2 CU 15KV cable
for UG circuits

$\frac{1}{2}$ or Δ primary transformers
can be switched between the two
from the outside

boost 7200 to 12.47KV also
since the transformers (2400 - 7200)
have to be changed out

ground - 4 poles/mile

They use REA 50-3 standards for O.H.
design -

Wed
8-30-95
Notes from driving around base with Hawley

most damage due to being hit by snowplows

replace about 10% of arm

" " 50% of glass

add a new pin & glass 100%

take an outage to pull in neutral
cable - 4-8 hours

1. do all lines first

2. do transformers second - a feeder at
a time - take outage only for pull new lines
single phase can - switch from ⁱⁿ (neutral)
one phase to neutral

three phase cans - rewire completely

3. need two banks for a while
2400 Δ 3 4160 YGRD

4. remove series street light circuit
that still remains to install
neutral - since street lighting gone

5. replace fiberglass hi arms with
new crossarm where necessary

6. Most difficult area - right in front of
power plant due to congestion

7. All 3 of padmount will have to be changed out
completely

8. change 3 ^{glass} ~~from 2400 to 5KV~~ } ³⁰ ~~30~~ minutes
add 1 new glass for neutral

9. remove 3 ϕ fiberglass tri-arm } ^{1 1/2 - 2}
add 8' crossarm } hours
sand wire on insulators
add neutral insulator

Notes: Monday 8-28-95 8:30 AST

1. Black Rapids facility is not fed from Ft. Greely power system - It has its own generators and is a stand alone facility.

~~2. Ser No Eng 96507-62-13
Changed to 71-03-03
July 1962
Additional Electrical Peakers
Plates J 25, K 24 etc
13 sheets~~

~~3. Sheet 51 ?~~

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JOB Ft. Greeley EEAP Study
 SHEET NO. 1 OF 4
 CALCULATED BY F. Jones DATE 8-25-95
 CHECKED BY _____ DATE _____
 SCALE N/A

1. GUEA transformer is 2500 KW upgraded to ³¹²⁵ ~~2500~~ KW recently (added fans).
2. The load in the winter can get up to 3400-3500 KW so a generator is brought on line to cover the peak.
3. There is enough generation to supply the whole base and they often do when GUEA goes down.

Feeder Breakers AM-5-50-4

G.E.

Inst. Bulletin

Serial # 396A571-3

Magn Blast

GEE-23903

1200 A, 4160 V 60cy

GEE-3391
Parts

4760 V. max

8cy interrupting time

50 MVA interrupting rating

7000 A inter... " @ rated V.

12500 A max interrupting

20000 A momentary

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JOB Ft. Greely EEAP Study
SHEET NO. 2 OF 4
CALCULATED BY F. Jones DATE 8-25-95
CHECKED BY _____ DATE _____
SCALE _____

Westinghouse DE-10W Air Circuit Bkr

4.16 KW

4.76 Max KV

1200 A 60 cy

5/1963 manufacture date

SSB6621A30

SD DH 75

GURA transformer

2800 KVA

%Z = 5.95

24.94/14.4 Y₄ / 2400A

Added fans to go to 3125 KVA

When Base Load gets to about 2800 KW,
a generator is started and loaded to
1000 KW. to relieve the transformer.

E M C ENGINEERS, INC.

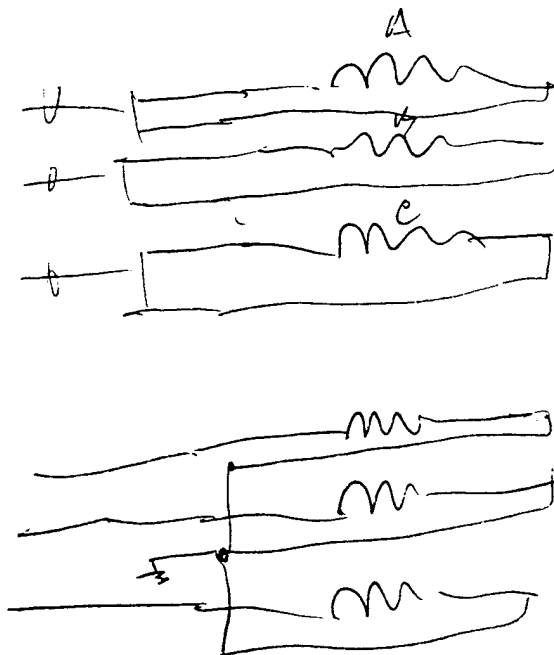
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Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB Et. Greeley EEAP Study
SHEET NO. 3 OF 4
CALCULATED BY F. Jones DATE 8/25/95
CHECKED BY _____ DATE _____
SCALE _____

generators can be rewired for 4160 Y₂
from 2400V Δ 1280 6 leads

Elliott Gen
Ridgeway, Pa

Don't know about the 1000's though
looks like only 3 leads brought out



check
with
Elliott
for values
of windings

Generators

1-3 - connected
2400V. Y
ungrounded

4,5 - connected
2400V. Δ

can be rewired
for 4160 Y
per the nameplate

takes 21 days to get film developed

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9755 Dogwood Rd. Suite 220
Roswell, GA 30075 (404) 642-1864

JOB Ft. Greely E&AP Study
SHEET NO. 4 OF 4
CALCULATED BY E. Jones DATE 8/25/95
CHECKED BY _____ DATE _____
SCALE _____

Sat.

1. go through log book
get peak demand
2. open j. box of 1000's
see if they can be rewired for T_7
4160V?
3. figure out overhead ties out front
if possible
4. take pictures
5. get more data of trans. & machines
6. get copies of daily (24 HR sheet)
of loads for last year
7. get copies of relay drawings & find
out where readings are from.
8. tape record the nameplate data of the
generators & the transformer in case photos
don't turn out. Takes 21 days to get film developed.

APPENDIX C

Pole Testing Notes

installed ~ 1948
Near Bldg 162 - OLD Post - guess 40/2
① Sounded solid to the hammer
good ring

Drilling butt - seemed soft but it was
a cedar pole which is soft anyway
shavings were very fine and seemed
a bit damp to the touch
a lot of severe checks

② Near Bldgs 400 area - Middle Post
guess 50/2 pole, installed ~ 1955
Had sort of a crack sound to the hammer
more of a thud with a crack.

Drilling butt - seemed soft again in the butt
but it is cedar - shavings fine and felt a bit
moist to the touch.

Drilled a hole about 5 ft up the pole and it
felt a bit more resistant than butt drill
a lot of severe checks

③ Near Bldg 400 area - Middle Post
45/2 installed ~ 1985

Had a good crack when you hit it with the
hammer - sounded really solid

Drilling butt - seemed soft again but slightly
more resistant than ① & ② above

shavings were fine & seemed dry to the touch
The butts of even the old poles are probably in
pretty good shape compared to the #③ pole
no checks

④ Near AAF - OLD POST - Bldg 100
installed 1966 45/2 copper sulfate
treated - few checking
Sounded really solid to the hammer
good cracking sound - good sharp
Crack

Drilling butt - seemed soft going in
got very stiff about $\frac{1}{2}$ of drill bit in
at a 45° angle - may have hit a knot
initially felt about the same as #③

⑤ Near main gate, at Richardson Highway
installed 1957 45/2 penta treated (reddish)
Sounded really solid to the hammer good
crack - moderate checking
Drilling butt - very, very tough drilling
switched to a battery drill however
so that difference in torque may have
made a difference

⑥ on Bolio Lake line 7200V, installed 1975
45/3 pole - moderate checking
Sounded really solid to the hammer - not
hollow

Drilling butt - very, very tough drilling
used battery drill however so the difference
in torque may have been significant

100' ruling span

{ Crassum rot is prevalent
Damage by snow plows is prevalent
Carpenter ants on cedar poles is
moderately prevalent
→ most problems

(7) 1977 45/3 not sure of treatment.
ASP lateral off of feeder 7 near the
garage lagoon. few checks
Sounded very solid to the hammer.
Pulling butt: very, very difficult
using battery powered drill again
hard to compare with previous
drillings.



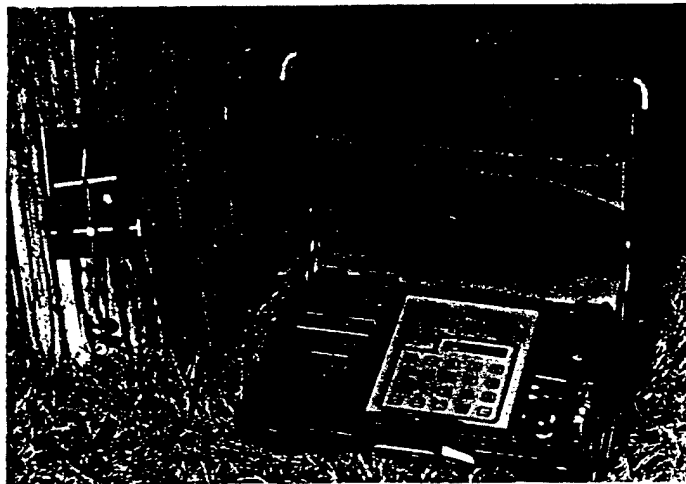
ASSESS THE STRENGTH OF YOUR WOOD POLES IN ONLY 3 TO 5 MINUTES!!

PoleTest™ is a simple-to-use instrument for predicting the bending strength of wood poles.

WHY STRENGTH?

Your system design is based on strength and your maintenance and upgrading decisions should be also.

All wood poles of the same species do not have the same fiber strength. In fact, based on the results of destructive tests, some poles of the same species and class may be more than three times stronger than others. Older poles may have an even wider range of strength. People working with wood recognize that poles exhibit significant strength variation but no one can distinguish a weak pole from a strong pole based on a visual inspection.



PoleTest™ is the ONLY wood pole test device which directly predicts pole strength. The reliability of the strength prediction using **PoleTest™** is unmatched by any other method, technique or instrument.

PoleTest™ is the culmination of research sponsored by EPRI* and EDM. **PoleTest™** is based on thousands of actual full-scale destructive tests and is not simply a theoretical approach. This extensive data base is available only in **PoleTest™**.

POLETEST™ USES:

- Determine the strength of wood poles
- Project future maintenance requirements
- Make upgrade or reconductor decisions
- Sort new poles to optimize use
- Make pole repair/replacement decisions
- Determine code conformance
- Determine line reliability
- Failure assessment and litigation support



ENGINEERING DATA MANAGEMENT, INC.

4700 McMurray Ave., Bldg. A
Fort Collins, Colorado 80525
Phone: 303/223-0457
Fax: 303/223-0484

* PoleTest™ incorporates technology developed for the Electric Power Industry under the sponsorship of the Electric Power Research Institute. (EPRI).

JOIN THE LIST OF POLETEST™ USERS WHO ARE CURRENTLY SAVING MONEY BY MORE EFFECTIVELY MANAGING THEIR WOOD POLES

Pole Strength Assessment:

Destructive testing was conducted for *Tampa Electric Co.* on 24 southern pine poles that had been rejected using conventional inspection methods and 25 poles that were judged acceptable. Results showed that 50% of the rejected poles had adequate strength to remain in service, while 30% of the accepted poles did not have adequate strength.

Result - greater life from the good poles and greater reliability from the lines.

Upgrading and Rebuilding:

United Power Association used PoleTest™ to evaluate a line to be upgraded. Several weak poles in the line were identified while the majority of poles were found to have sufficient strength to allow a cost-effective upgrade.

Result - A cost-effective upgrade was possible while retaining the reliability of the line.

Inspection Programs:

Idaho Power Company used PoleTest™ to evaluate the strength of an older line that was getting expensive to maintain. The strength information indicated that replacing or repairing a small number of structures would result in the reliability of the line returning to an acceptable level.

Result - The life extension of the line proved to be a cost-effective option.

Montana Power is using PoleTest™ to identify weak poles which require repair or replacement before winter. In addition, maintenance can be planned for the following year to repair structures that were found to be marginal, but not critical this year.

Result - Greater reliability of the lines and better utilization of existing manhours.

Maintenance and Replacement:

The *Electric Power Research Institute* (EPRI) says: Using present inspection methods, approximately 667 poles of a 10,000-pole line would be replaced annually. If by using the EPRI-developed NDE method to inspect poles, the useful life of only one-third of these 667 poles is extended 5 years, then the potential savings to the utility is on the order of \$1,000,000 per year.



**LET EDM SHOW YOU HOW TO
COST EFFECTIVELY EXTEND THE LIFE AND INCREASE
THE RELIABILITY OF YOUR WOOD POLE LINES.**

get-it™ brand

Fax Transmittal Memo 7672

No. of Pages 1

Today's Date 12/13/95 Time 11:45am MST

Fred Jones

From Chuck Paulien

Company EDM

Location

Dept. Charge

Location

Fax #

Telephone #

Fax #

Telephone #

303-985-2527

Comments: Fred, Here is the Table Joe asked me to Fax to you. If you have any more questions give me or Joe a call.
Chuck Paulien

Original Disposition:

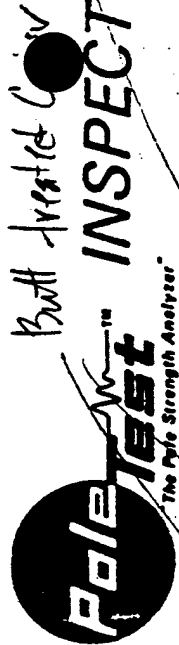
☐ Destroy☐ Return☐ Call for pickup

PoleTest™

Technical Supplement

Table 7
Typical Strength Limits for Use with PoleTest™

	Douglas-fir		Southern Pine		Western Redcedar	
	GL	Local	GL	Local	GL	Local
Grade B	3040	3400	4160	3390	2180	1900
Grade C (at Crossings)	2390	2550	2950	2600	1680	1560
Grade C (Elsewhere)	3770	3960	4550	4110	2560	2450



INSPECTION REPORT

Butt treated
Copper sulfide treated

crossed all the way

LINE OWNER: _____
DIVISION: _____
LINE LOCATION: ① _____
INSPECTOR: _____
DATE INSPECTED: ② _____
POLETEST SERIAL NO.: ③ _____
ACCELEROMETER SERIAL NO.: _____
SHEET _____ OF _____
A: ④ _____
B: ⑤ _____

POLE ID	F5L71	F5314	F5L41	F5L88	F4L43	1st pole in 1971B	P7L61		
SPECIES	WC	WC	DF	WC	DF	WC	DF		
GROUNDLINE DIAMETER (IN.)	13.8	14.3	15.2	13.0	13.6	13.7	12.3		
ACCELEROMETER ORIENTATION	45° LL	P	P	P	P	P	P		
GROUNDLINE READING (PSI)	4500	4260	4180	4750	6820	5140	6710		
LOCAL DIAMETER (IN.)									
LOCATION	GL	GL	GL	GL	GL	GL	GL		
ACCELEROMETER ORIENTATION									
LOCAL READING (PSI)									
COMMENTS									

SPECIES CODE:
DF - DOUGLAS-FIR
SP - SOUTHERN PINE
WC - WESTERN REDCEDAR
O - OTHER

ACCELEROMETER ORIENTATION CODE:
P - PERPENDICULAR TO LINE
IL - IN-LINE

LOCATION CODE:
GL - GROUNDLINE
XB - X-BRACE
XA - CROSSARM
O - OTHER, SPECIFY

ENGINEERING DIVISION
WOOD POLE MANAGEMENT
AND CONSULTING SERVICES



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FORT COLLINS, CO

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produce the final product. This classification includes upholstering operations.

2915 **N/A—NY**
PHRASEOLOGY VENEER PRODUCTS MFG. Includes veneer manufacturing.

CROSS-REF. State Special: Texas—Veneer Mfg.

SCOPE This classification applies to insureds who manufacture veneer and further process the veneer into a product. The sawing of logs into bolts, the softening of same in vats of hot water or steam rooms, then either turning, slicing or sawing and the final clipping of the single ply sheets to size and drying are the operations performed in the manufacture of rough veneer. Some rough veneer may be sold as a product.

The operations involved in the manufacture of veneer products will vary depending on the product to be manufactured. Wire stapling machines, wire hoop machines, clippers, table saws and, in some instances, punch presses for making metal parts are utilized in the manufacture of veneer barrels, baskets of woven veneer, wire staple baskets or wire staple fruit hampers of stripped veneer, tacked or wire staple berry boxes of sheet veneer and wire bound fruit crates of stripped veneer with or without turned wood slabs or ends.

In the manufacture of veneer seats, veneer panels, plywood panels and veneer covered furniture cores, wire working machines do not prevail but are supplanted by taping, gluing, clamping or pressing machines which are used to assemble the single ply veneer into two, three, four or more ply products. All veneer products operations, irrespective of character, are readily identified by the presence of a large amount of assembly work.

2916 **N/A—CA**
PHRASEOLOGY VENEER PRODUCTS MFG.—NO VENEER MFG.

SCOPE Code 2916 applies to insureds who manufacture products made from veneer but do not manufacture the veneer used in such products. "Veneer" has been defined as a thin layer of material, usually made of wood or plastic, which is used to cover the surface of another material. Veneer in most instances will have a superior quality surface when compared to the surface it covers. Refer to Code 2915 for risks which manufacture veneer and further process the veneer into a product. Refer to Code 4250 for risks which engage in the lamination of paper to manufacture paper or paper-like products.

As veneer-covered products are many and varied, there may be little operational similarity between risks contemplated by Code 2916.

Wire stapling machines, wire hoop machines, clippers, table saws and, in some instances, punch presses for making metal parts are utilized in the manufacture of woven, stripped or wire stapled veneer products such as barrels, baskets, fruit hampers, berry boxes and fruit crates with or without turned wood slabs or ends.

Taping, gluing, clamping and/or pressing machines are used to manufacture veneered products such as seats, panels, plywood, kitchen counter tops, desk tops, sink tops, chalkboards, bulletin boards and furniture cores. The manufacture of these products will generally involve the lamination of vinyl or plastic top coverings to particle boards. While the assembly of these products usually consists of the application of a single-ply veneer to another surface, processes that involve multi-ply applications are additionally contemplated by Code 2916.

Insureds who cover sheetrock with wallpaper have been assigned to Code 2916; however, wallpapering of walls is not considered a veneering operation and is contemplated by either Code 5474 or 5481.

All veneer product operations, irrespective of character, are readily identified by the presence of a large amount of assembly work involving the combining of two or more surfaces to each other.

2923
PHRASEOLOGY PIANO MFG. Includes assembling or finishing operations, and manufacturing of the piano action. Also applies to player pianos.

CROSS-REF. Musical Instrument Mfg.—Wood—NOC; Organ Building & Installation.

SCOPE This is a product classification which includes fabrication of metal frames, sounding boards, keyboards, wire and string graduation.

Musical Instrument Manufacturing—Wood—NOC—contemplates the manufacture of instruments made of wood. Case manufacturing and the tanning of skins used in manufacturing wooden drums, tambourines and banjos have been considered incidental to the operations assigned to Code 2923.

Organ Building And Installation—contemplates the manufacture of the complete organ including installation as well as the manufacture of the keyboards, sounding boards, action boards, metal frames, metal organ pipes, switches, relays, magnets, wind chests, wind reservoirs and blower systems.

2942 **N/A—CA, MN**
PHRASEOLOGY PENCIL MFG.

CROSS-REF. Crayon Mfg.; Penholder Mfg.

SCOPE Applicable to the manufacture of crayons, pen holders, lead, wax copying and colored pencils encased in wood. Operations usually begin with raw logs, or pencil slats which are purchased from pencil stock manufacturers. Equipment involves grinding mills, wood shapers, kilns, extrusion press, punch press and dipping or spraying apparatus. Metal eraser tips are stamped out on presses and fitted with rubber erasers either by the insured or by subcontractors.

2960
PHRASEOLOGY WOOD PRESERVING & DRIVERS. Includes yard or incidental woodworking operations.

CROSS-REF. Tie Yard & Drivers—includes preserving operations. Codes 2960 and 8232—Lumberyard or 2702—Logging or Lumbering shall not be assigned to the same risk unless the operations described by these classifications are conducted as separate and distinct businesses. Pole Yard & Drivers. This cross-reference has the same footnote as Tie Yard & Drivers.

SCOPE Wood piles, poles, crossties, lumber and items to be preserved are delivered at treating plant where the items are peeled, seasoned (air- or kiln-dried) and machined, if necessary, before treating. Preservatives fall into two general classes: oils, such as creosote and petroleum solutions of pentachlorophenol, and waterborne salts applied as water solutions. The preservative may be applied by pressure or superficially by spraying, brushing, dipping and soaking. Treated wood is then inspected, stored and shipped.

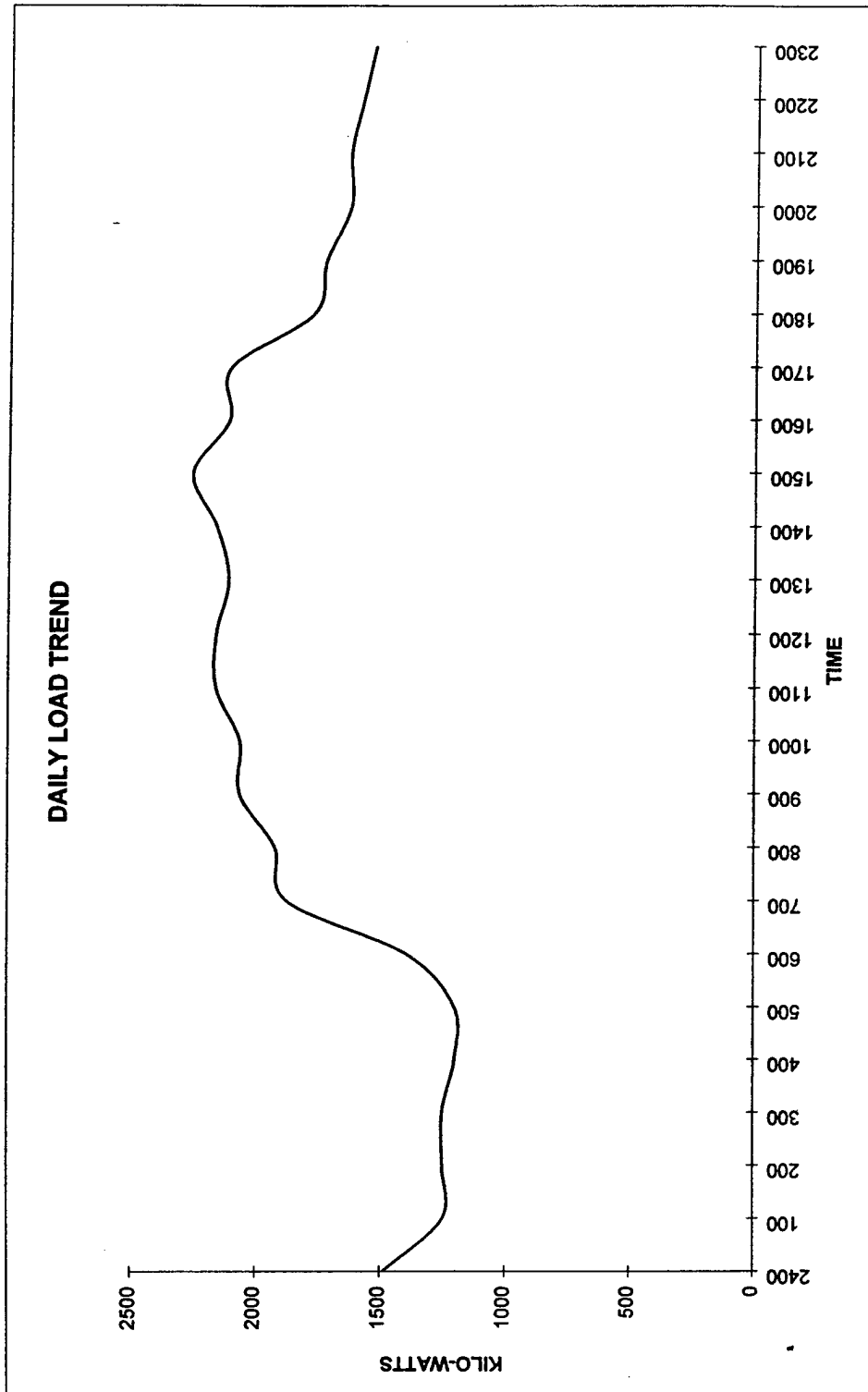
APPENDIX D

Load Analysis

JULY 1995

Electric Power Plant Operating Log For
5-Jul-95

TIME	PLANT TOTALIZER METER
2400	1488
100	1248
200	1248
300	1248
400	1200
500	1200
600	1392
700	1872
800	1920
900	2064
1000	2064
1100	2160
1200	2160
1300	2112
1400	2160
1500	2256
1600	2112
1700	2106
1800	1776
1900	1728
2000	1632
2100	1632
2200	1584
2300	1536

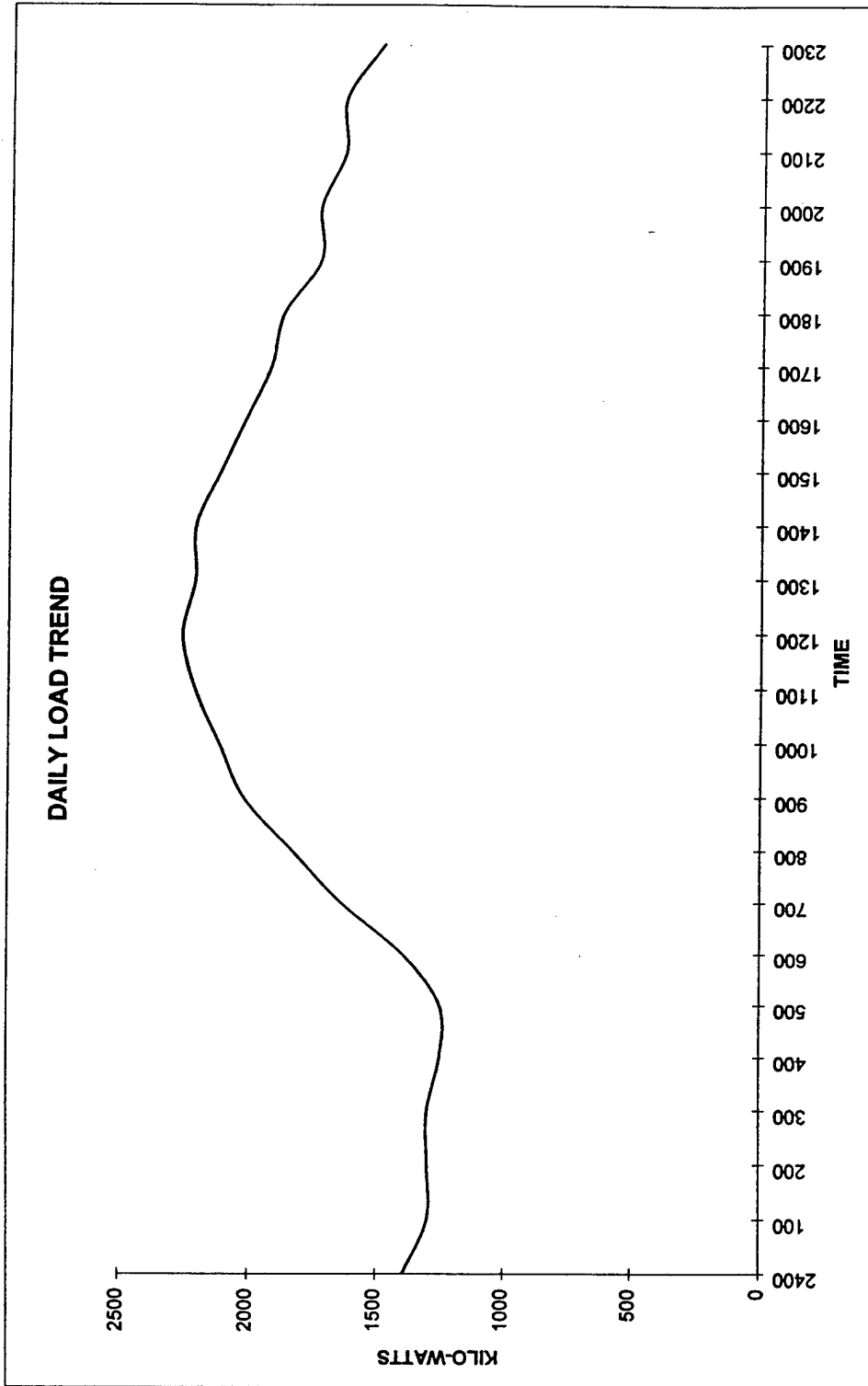


TOTAL KWH 41898
PEAK KW 2256
LOAD FACTOR 77.4%

JUNE 95

Electric Power Plant Operating Log For
23-Jun-95

TIME	PLANT TOTALIZER METER
2400	1392
100	1296
200	1296
300	1296
400	1248
500	1248
600	1392
700	1632
800	1824
900	2016
1000	2112
1100	2208
1200	2256
1300	2208
1400	2206
1500	2112
1600	2016
1700	1920
1800	1872
1900	1728
2000	1728
2100	1634
2200	1632
2300	1488

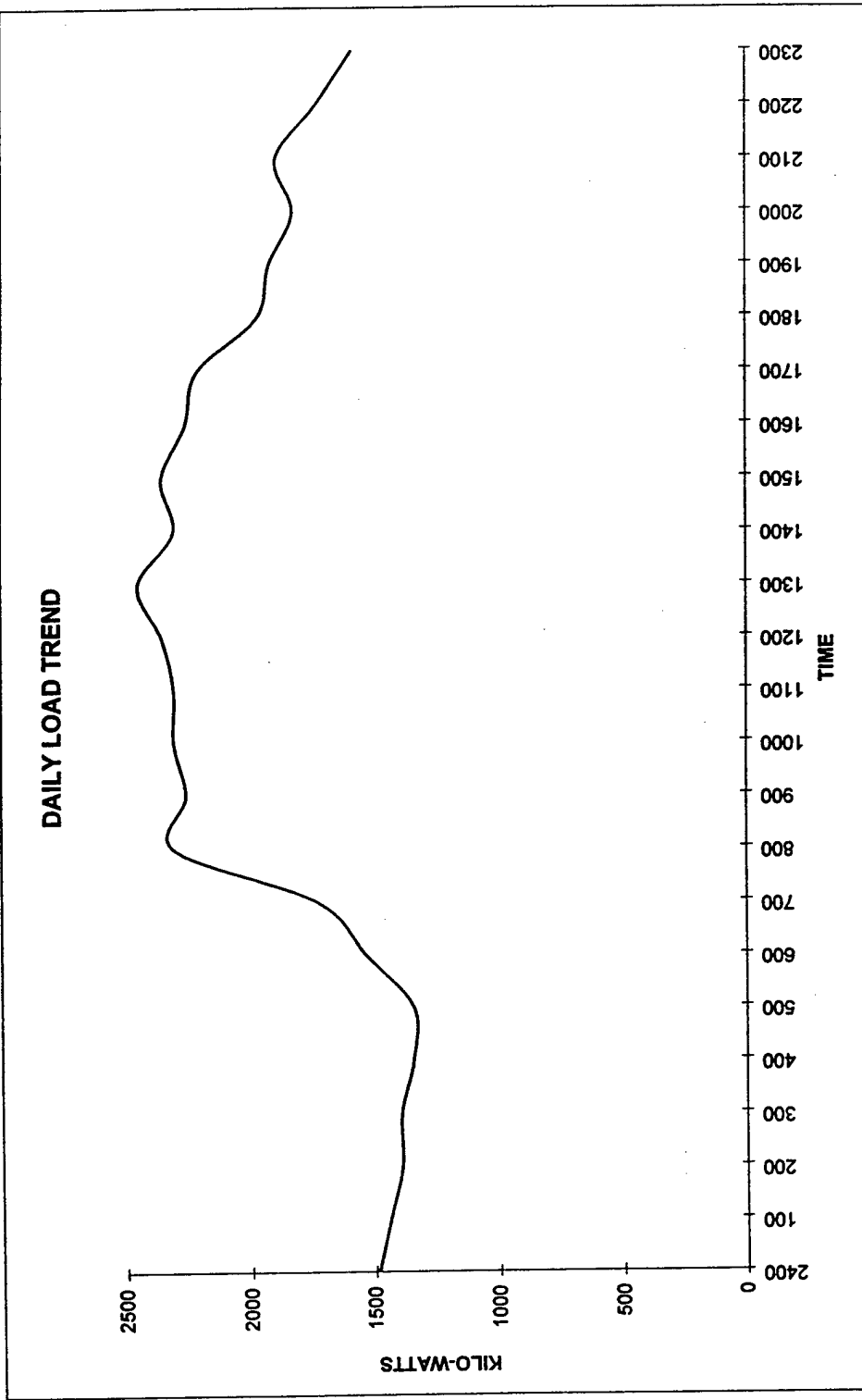


TOTAL KWH 41760
PEAK KW 2256
LOAD FACTOR 77.1%

MAY 1995

Electric Power Plant Operating Log For
16-May-95

TIME	PLANT TOTALIZER METER
2400	1488
100	1440
200	1392
300	1392
400	1344
500	1344
600	1536
700	1728
800	2304
900	2256
1000	2304
1100	2304
1200	2352
1300	2448
1400	2304
1500	2352
1600	2256
1700	2208
1800	1968
1900	1920
2000	1824
2100	1892
2200	1728
2300	1584

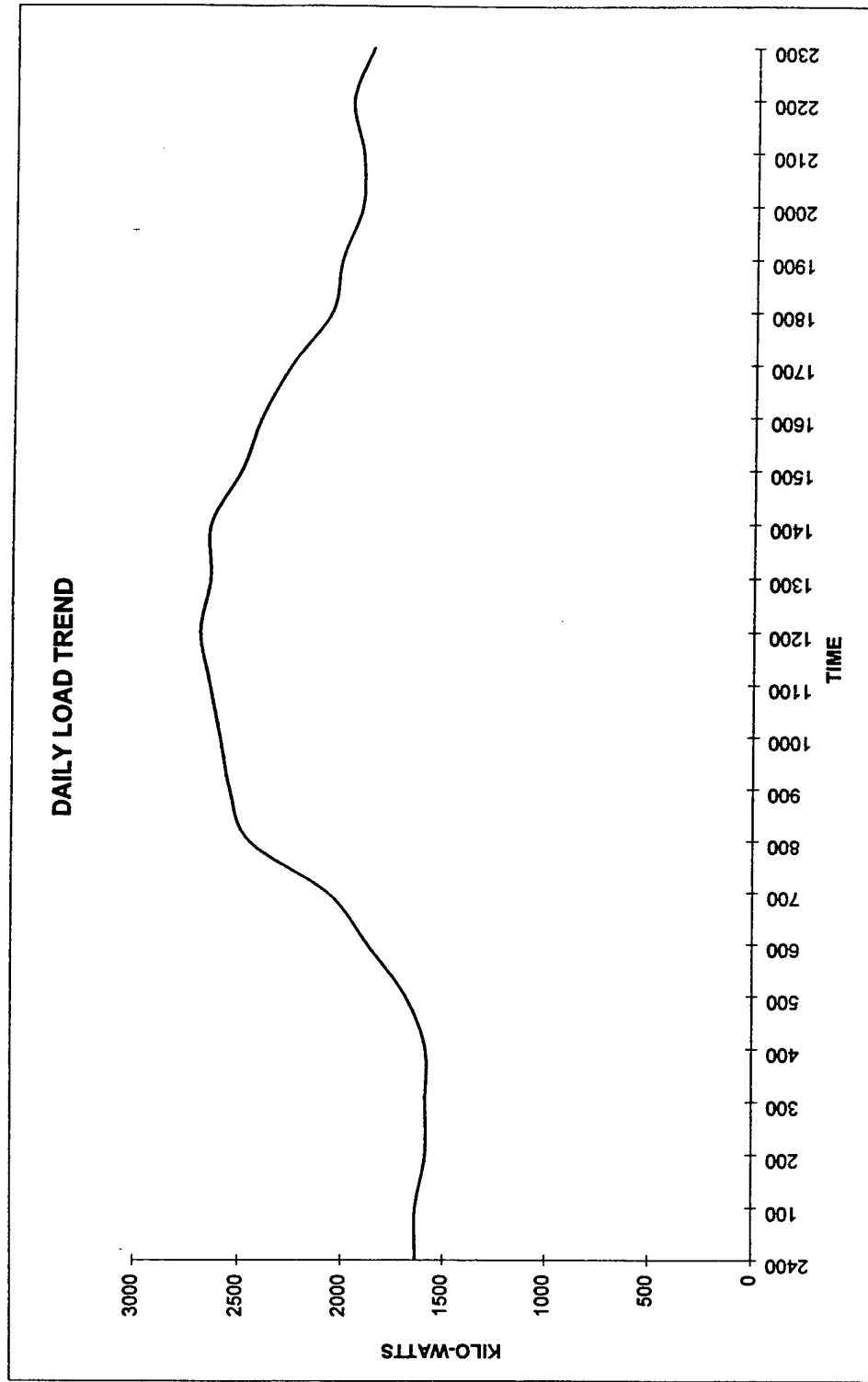


TOTAL KWH 45668
PEAK KW 2448
LOAD FACTOR 77.7%

APRIL 1995

Electric Power Plant Operating Log For
5-Apr-95

TIME	PLANT TOTALIZER METER
2400	1632
100	1632
200	1584
300	1584
400	1584
500	1682
600	1872
700	2064
800	2448
900	2544
1000	2592
1100	2640
1200	2688
1300	2640
1400	2640
1500	2496
1600	2400
1700	2256
1800	2064
1900	2016
2000	1920
2100	1920
2200	1968
2300	1872

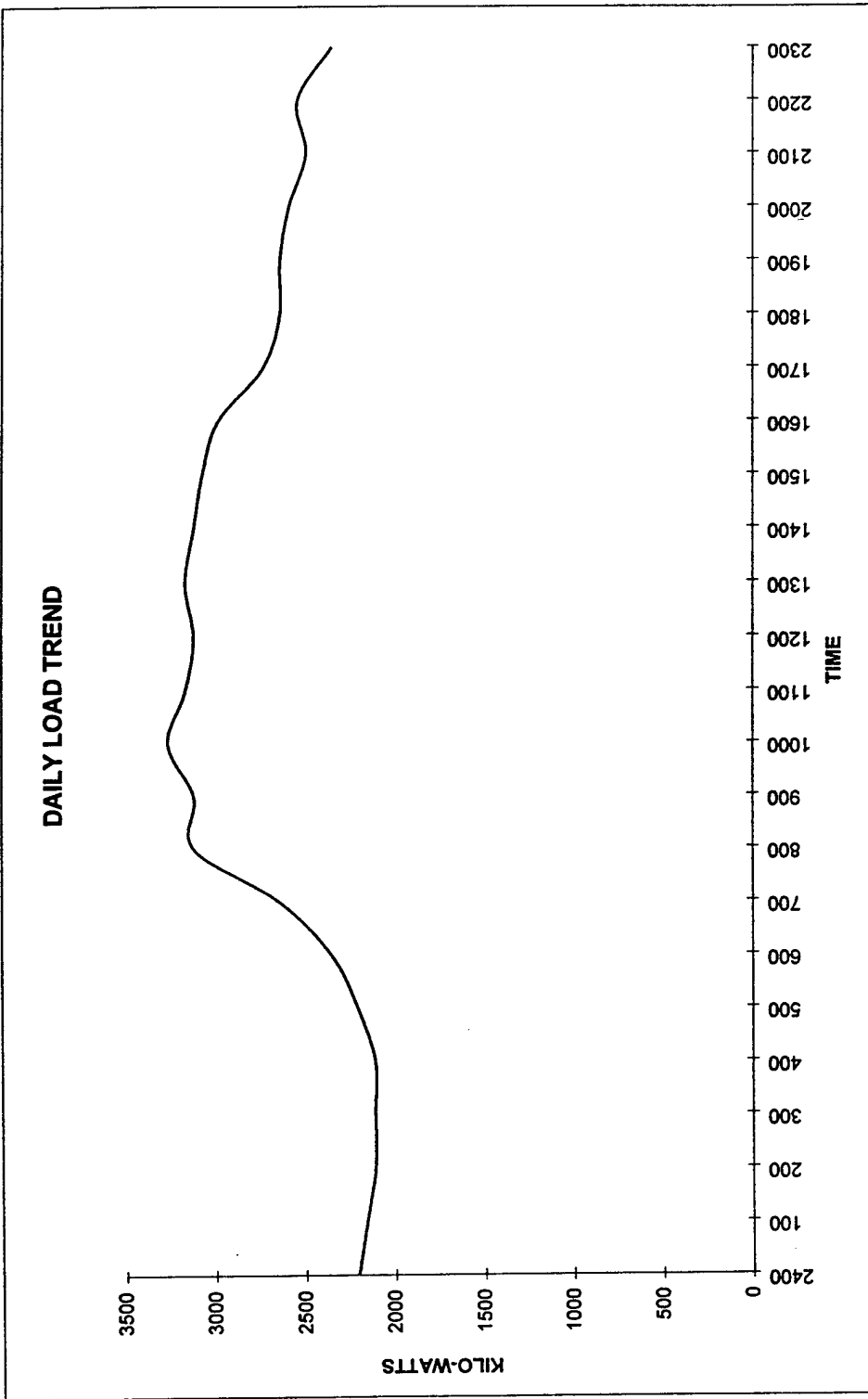


TOTAL KWH 50738
PEAK KW 2688
LOAD FACTOR 78.6%

MARCH 1995

Electric Power Plant Operating Log For
14-Mar-95

TIME	PLANT TOTALIZER METER
2400	2208
100	2160
200	2112
300	2112
400	2112
500	2208
600	2352
700	2640
800	3120
900	3120
1000	3264
1100	3168
1200	3120
1300	3168
1400	3120
1500	3072
1600	2986
1700	2736
1800	2640
1900	2640
2000	2592
2100	2496
2200	2544
2300	2354

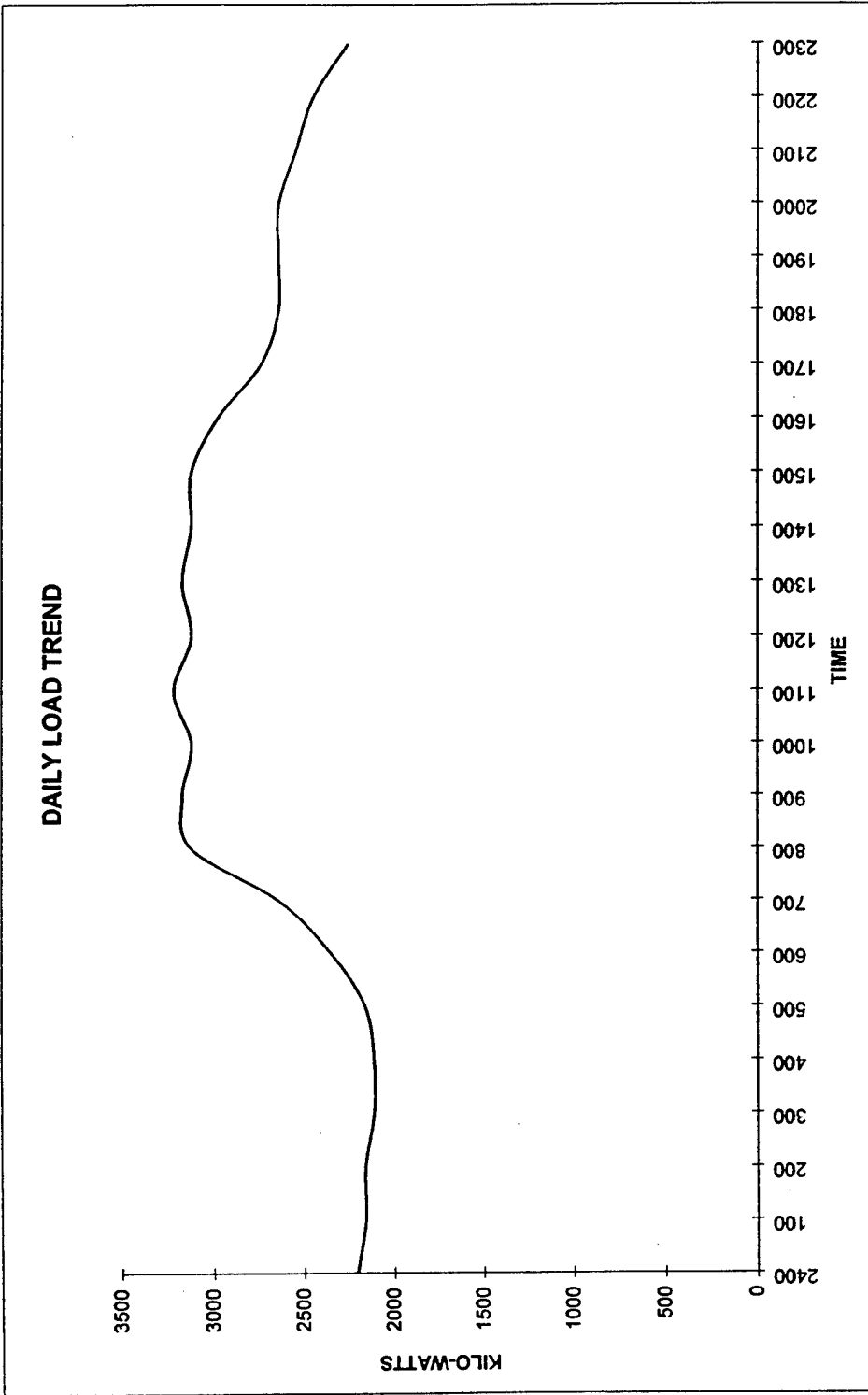


TOTAL KWH 64044
PEAK KW 3264
LOAD FACTOR 81.8%

FEB. 1995

Electric Power Plant Operating Log For
23-Feb-95

TIME	PLANT TOTALIZER METER
2400	2208
100	2160
200	2160
300	2112
400	2112
500	2160
600	2350
700	2640
800	3120
900	3168
1000	3120
1100	3216
1200	3120
1300	3168
1400	3120
1500	3120
1600	2976
1700	2736
1800	2640
1900	2640
2000	2640
2100	2544
2200	2448
2300	2256

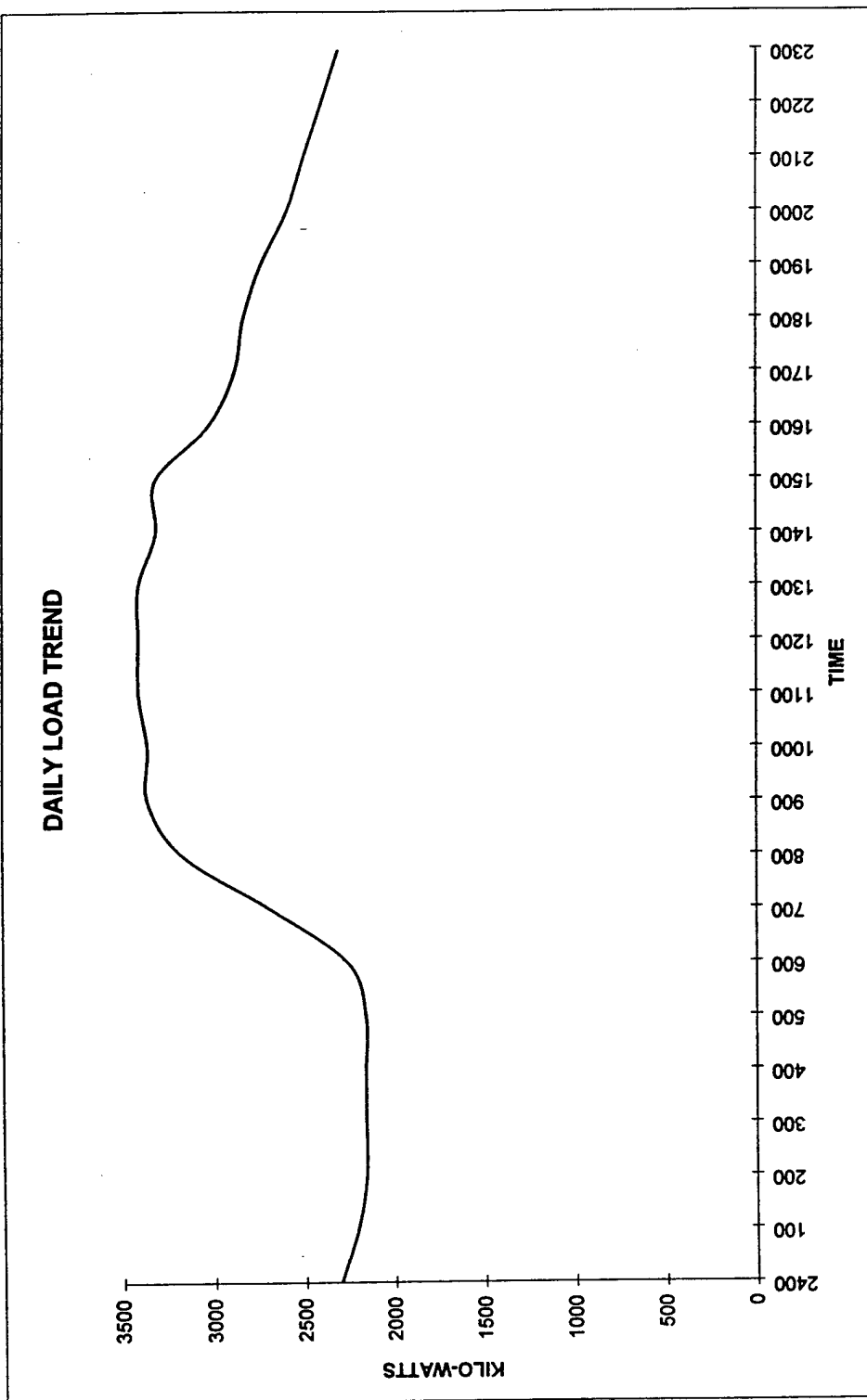


TOTAL KWH 63934
PEAK KW 3216
LOAD FACTOR 82.8%

JAN. 1995

Electric Power Plant Operating Log For
27-Jan-95

TIME	PLANT TOTALIZER METER
2400	2304
100	2208
200	2160
300	2160
400	2160
500	2160
600	2257
700	2688
800	3168
900	3360
1000	3360
1100	3408
1200	3408
1300	3408
1400	3312
1500	3312
1600	3024
1700	2880
1800	2832
1900	2736
2000	2592
2100	2496
2200	2400
2300	2304

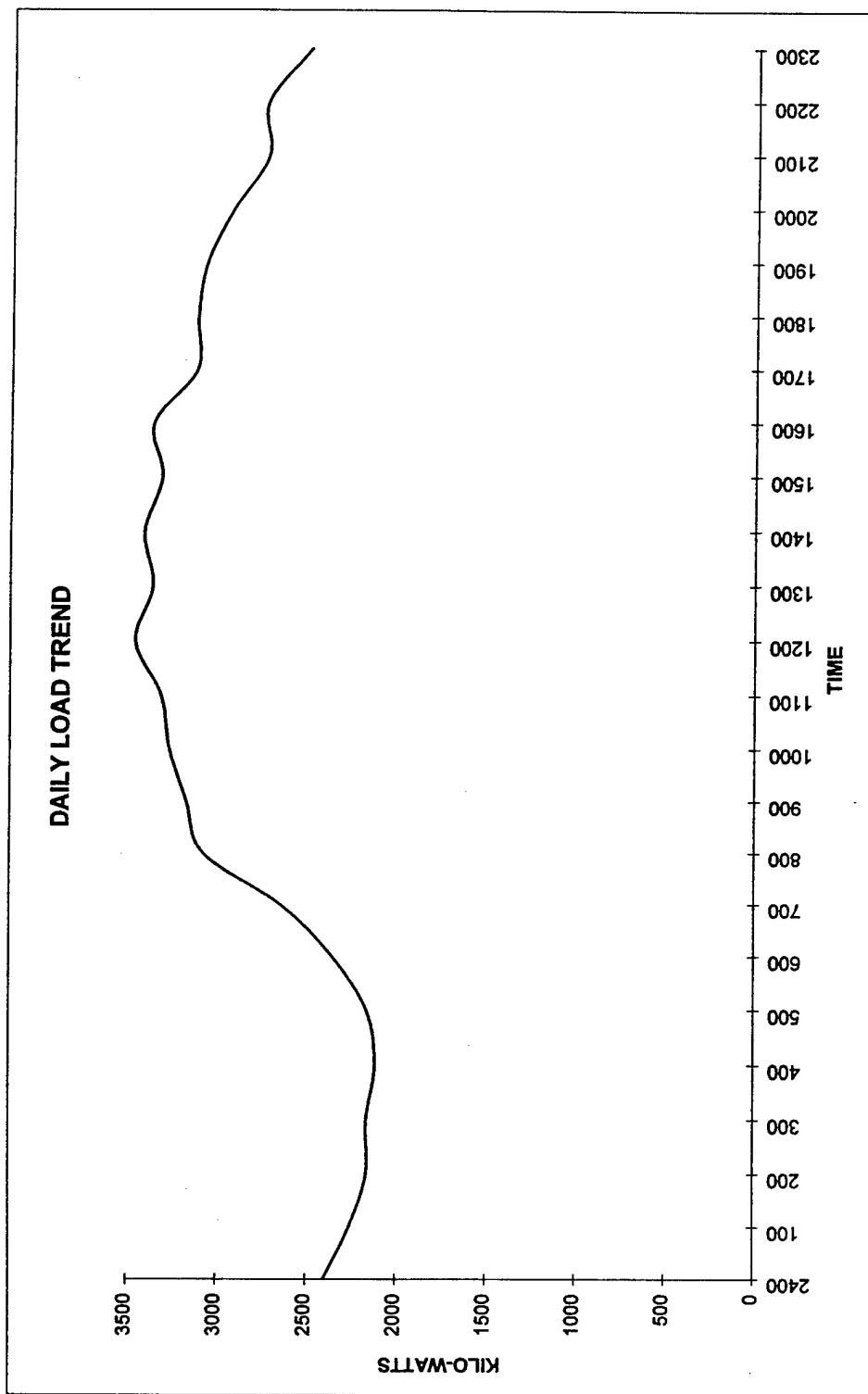


TOTAL KWH 66097
PEAK KW 3408
LOAD FACTOR 80.8%

DEC. 1994

Electric Power Plant Operating Log For
7-Dec-94

TIME	PLANT TOTALIZER METER
2400	2400
100	2256
200	2160
300	2160
400	2112
500	2160
600	2352
700	2640
800	3072
900	3168
1000	3264
1100	3312
1200	3456
1300	3360
1400	3408
1500	3312
1600	3360
1700	3122
1800	3120
1900	3072
2000	2928
2100	2732
2200	2736
2300	2496

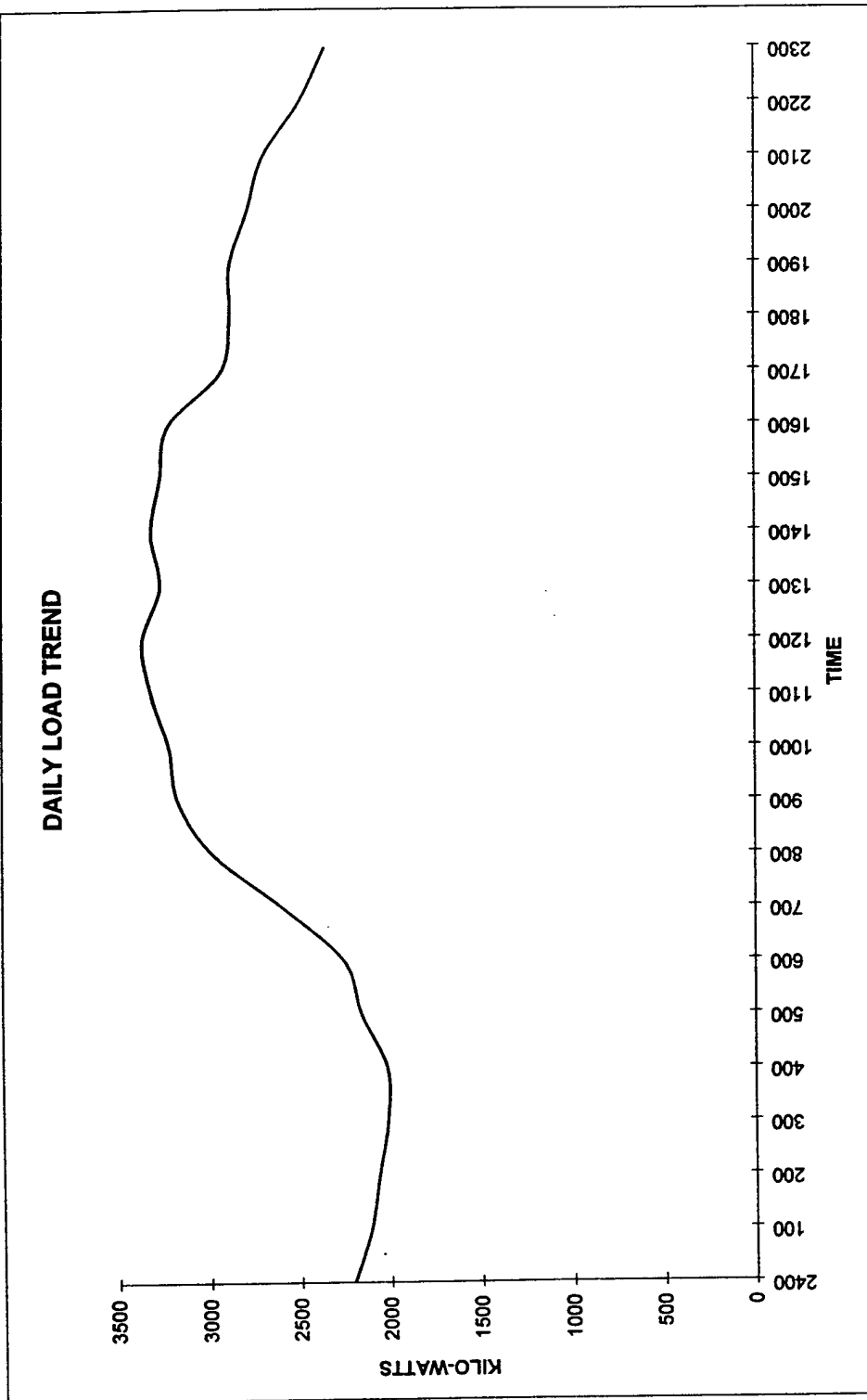


TOTAL KWH 68158
PEAK KW 3456
LOAD FACTOR 82.2%

NOV. 1994

Electric Power Plant Operating Log For
30-Nov-94

TIME	PLANT TOTALIZER METER
2400	2208
100	2112
200	2064
300	2016
400	2016
500	2160
600	2256
700	2592
800	2976
900	3168
1000	3216
1100	3312
1200	3360
1300	3264
1400	3312
1500	3264
1600	3216
1700	2928
1800	2880
1900	2880
2000	2784
2100	2698
2200	2496
2300	2352

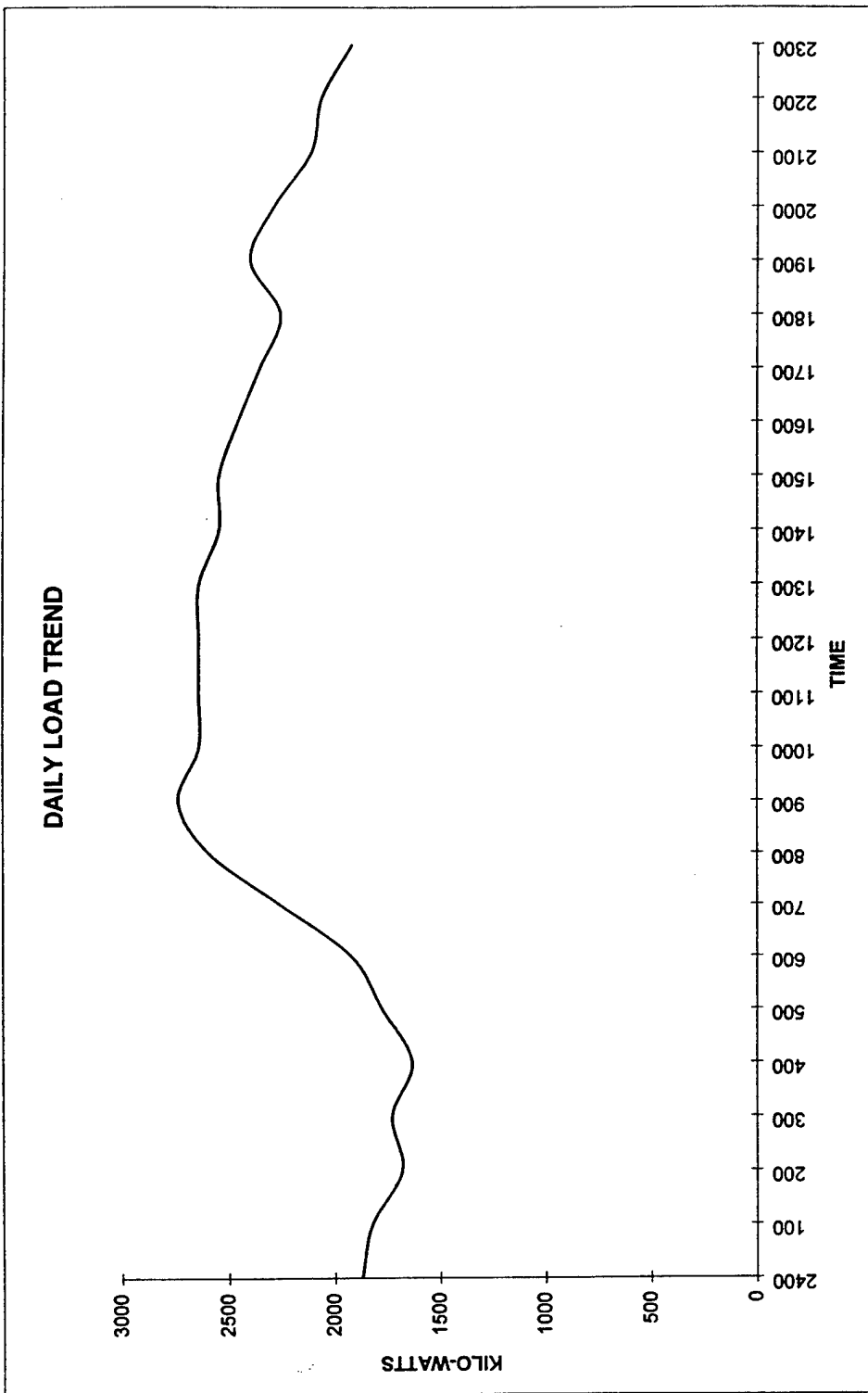


TOTAL KWH 65530
PEAK KW 3360
LOAD FACTOR 81.3%

OCT. 1994

Electric Power Plant Operating Log For
27-Oct-94

TIME	PLANT TOTALIZER METER
2400	1872
100	1824
200	1680
300	1728
400	1632
500	1776
600	1920
700	2256
800	2592
900	2736
1000	2640
1100	2640
1200	2640
1300	2640
1400	2544
1500	2544
1600	2456
1700	2352
1800	2256
1900	2400
2000	2286
2100	2112
2200	2064
2300	1920

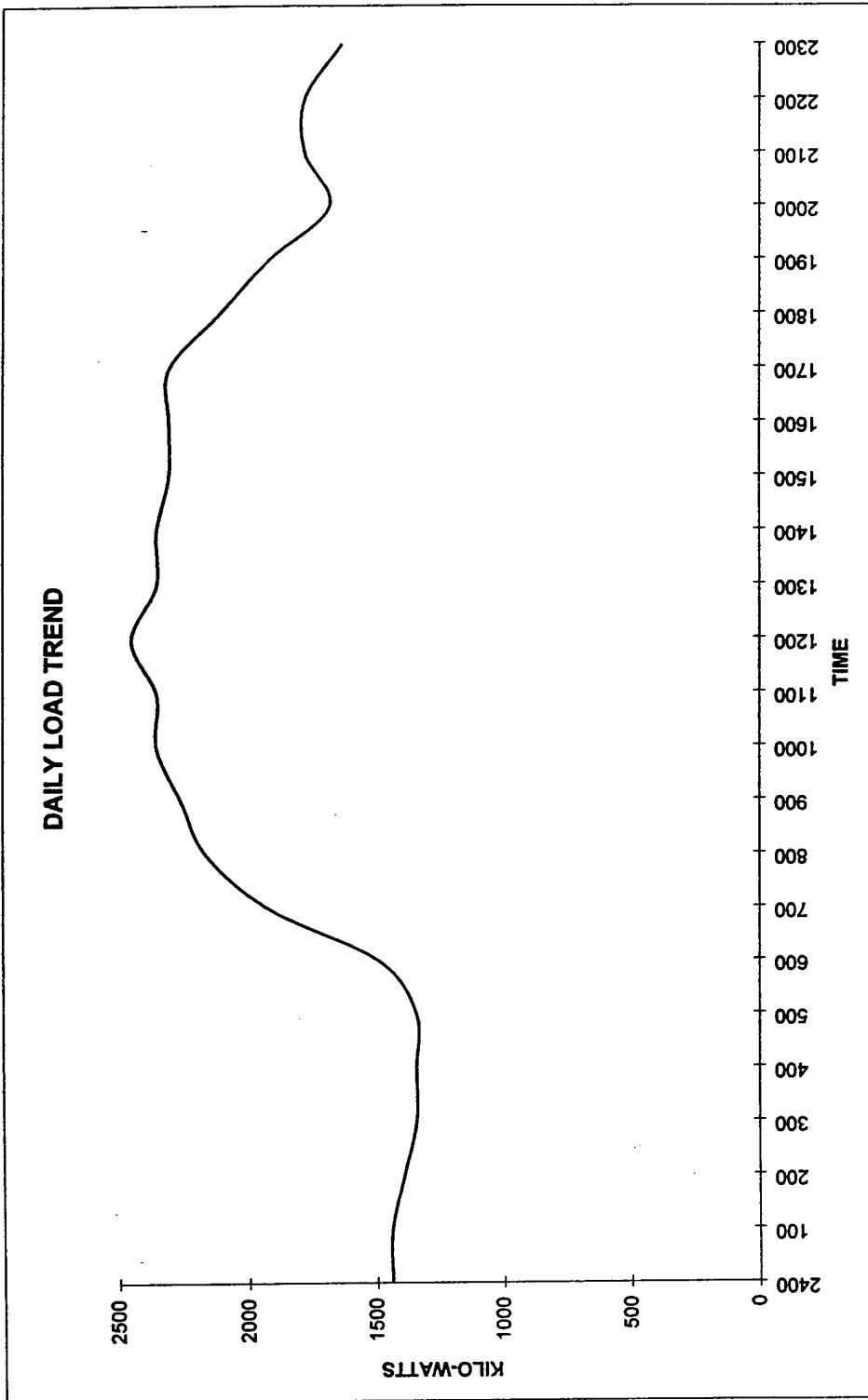


TOTAL KWH 53510
PEAK KW 2736
LOAD FACTOR 81.5%

SEPT. 1994

Electric Power Plant Operating Log For
14-Sep-94

TIME	PLANT TOTALIZER METER
2400	1440
100	1440
200	1392
300	1344
400	1344
500	1344
600	1488
700	1920
800	2160
900	2256
1000	2352
1100	2352
1200	2448
1300	2352
1400	2352
1500	2304
1600	2304
1700	2304
1800	2112
1900	1920
2000	1680
2100	1776
2200	1776
2300	1632

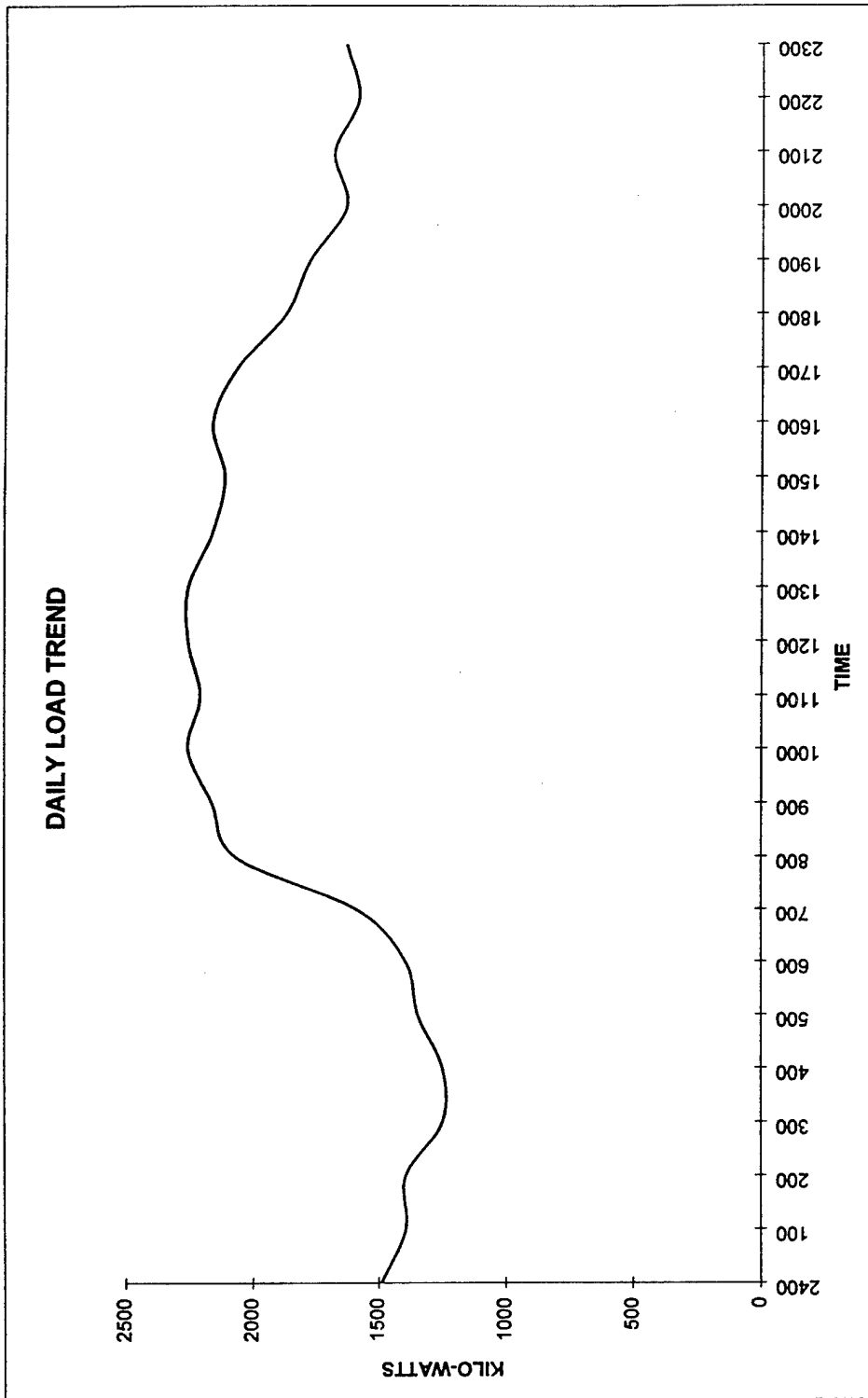


TOTAL KWH 45792
PEAK KW 2448
LOAD FACTOR 77.9%

AUGUST 1994

Electric Power Plant Operating Log For
29-Aug-94

TIME	PLANT TOTALIZER METER
2400	1488
100	1392
200	1392
300	1248
400	1248
500	1344
600	1392
700	1584
800	2064
900	2160
1000	2256
1100	2208
1200	2256
1300	2256
1400	2160
1500	2112
1600	2160
1700	2064
1800	1872
1900	1776
2000	1632
2100	1680
2200	1584
2300	1632

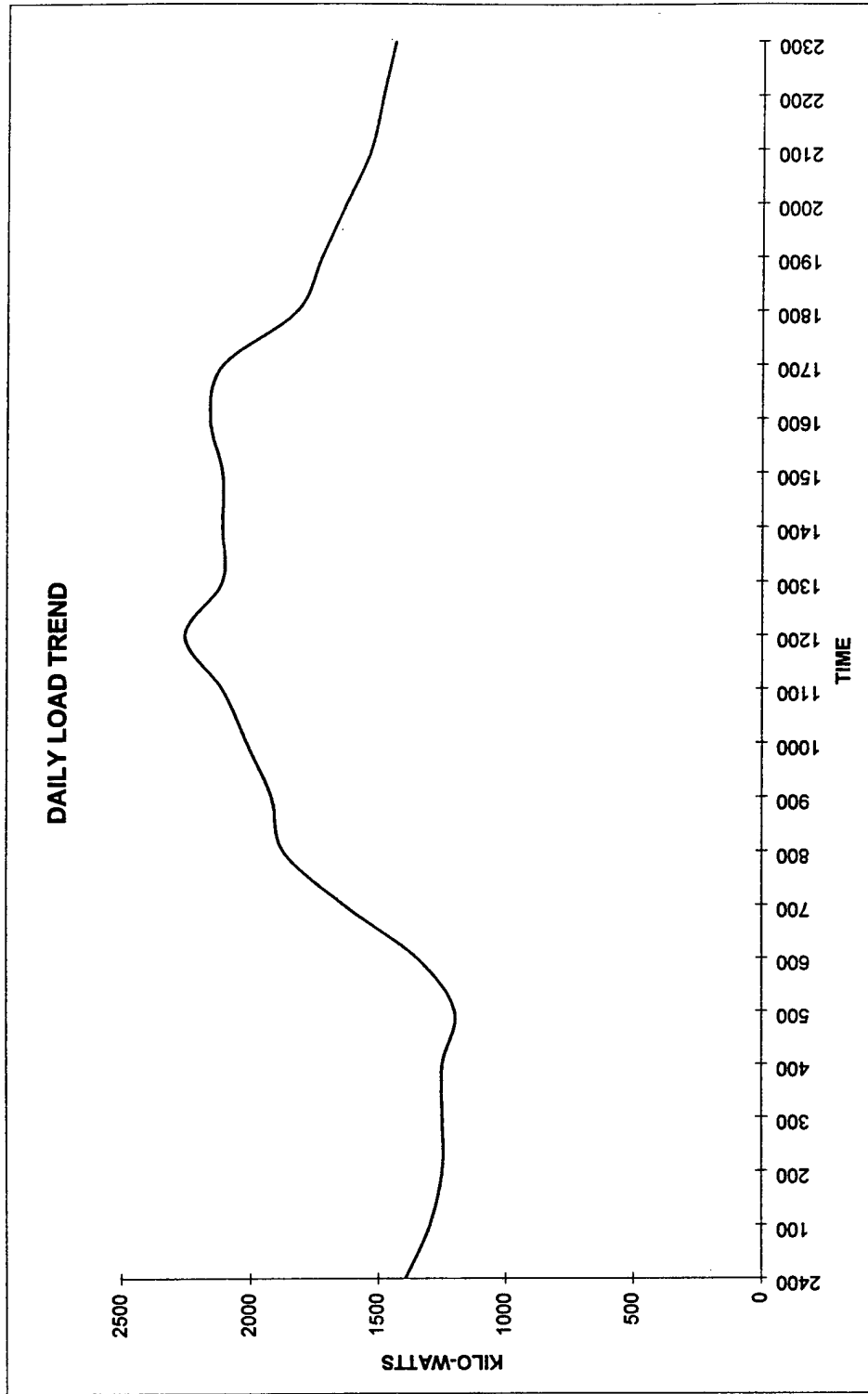


TOTAL KWH 42960
PEAK KW 2256
LOAD FACTOR 79.3%

JULY 1994

Electric Power Plant Operating Log For
21-Jul-94

TIME	PLANT TOTALIZER METER
2400	1392
100	1296
200	1248
300	1248
400	1248
500	1200
600	1344
700	1632
800	1872
900	1920
1000	2016
1100	2112
1200	2256
1300	2112
1400	2112
1500	2112
1600	2160
1700	2112
1800	1824
1900	1728
2000	1632
2100	1536
2200	1488
2300	1440



TOTAL KWH 41040
PEAK KW 2256
LOAD FACTOR 75.8%

ELECTRICAL GENERATION AND DISTRIBUTION LOG

DATE: 5/24/95

[illegible]

ELECTRIC POWER PLANT OPERATING LOG

DATE: 23 June 1995

ELECTRIC POWER PLANT OPERATING LOG

[illegible]

Hamilton
DAY OPERATOR

MIDNIGHT OPERATOR

AFTERNOON OPERATOR

FORM 300B
JUL 1 1966

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG

DATE: 16 May 91

GENERATORS										FEEDERS									
UNIT NO. 2		UNIT NO. 3		UNIT NO. 4		UNIT NO. 5		UNIT NO. 6		UNIT NO. 7		UNIT NO. 8		UNIT NO. 9		UNIT NO. 10		UNIT NO. 11	
LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.
KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR
AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%
2400	92	2400	92	2400	92	2400	92	2400	92	2400	92	2400	92	2400	92	2400	92	2400	92
0100		0100		0100		0100		0100		0100		0100		0100		0100		0100	
0200		0200		0200		0200		0200		0200		0200		0200		0200		0200	
0300		0300		0300		0300		0300		0300		0300		0300		0300		0300	
0400		0400		0400		0400		0400		0400		0400		0400		0400		0400	
0500		0500		0500		0500		0500		0500		0500		0500		0500		0500	
0600		0600		0600		0600		0600		0600		0600		0600		0600		0600	
0700		0700		0700		0700		0700		0700		0700		0700		0700		0700	
0800		0800		0800		0800		0800		0800		0800		0800		0800		0800	
0900		0900		0900		0900		0900		0900		0900		0900		0900		0900	
1000		1000		1000		1000		1000		1000		1000		1000		1000		1000	
1100		1100		1100		1100		1100		1100		1100		1100		1100		1100	
1200		1200		1200		1200		1200		1200		1200		1200		1200		1200	
1300		1300		1300		1300		1300		1300		1300		1300		1300		1300	
1400		1400		1400		1400		1400		1400		1400		1400		1400		1400	
1500		1500		1500		1500		1500		1500		1500		1500		1500		1500	
1600		1600		1600		1600		1600		1600		1600		1600		1600		1600	
1700		1700		1700		1700		1700		1700		1700		1700		1700		1700	
1800		1800		1800		1800		1800		1800		1800		1800		1800		1800	
1900		1900		1900		1900		1900		1900		1900		1900		1900		1900	
2000		2000		2000		2000		2000		2000		2000		2000		2000		2000	
2100		2100		2100		2100		2100		2100		2100		2100		2100		2100	
2200		2200		2200		2200		2200		2200		2200		2200		2200		2200	
2300		2300		2300		2300		2300		2300		2300		2300		2300		2300	
TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL	

DAY OPERATOR
Gibson / Hamilton

MIDNIGHT OPERATOR
B. Brown

AFTERNOON OPERATOR
[Signature]

PREVIOUS EDITION IS OBSOLETE

11-2 BDE FORM 216
1 JUL 88

DATE: 5 Apr: 1955

ESTIMATING THE ECONOMIC BENEFITS OF ELECTRICAL GENERATION AND DISTRIBUTION

INSTITUTION: FORT GREENLY, AK.

GENERATORS

SEEDS

[illegible]

Benson
AFTERNOON OPERATOR

DAY OPERATOR

MIDNIGHT OPERATOR

PREVIOUS EDITION IS OBSOLETE

1-2 BDE FORM 216

INSTALLATION: FORT GREENLY, AK.

ELECTRIC POWER PLANT OPERATING LOG

ELECTRICAL GENERATION AND DISTRIBUTION LOG

DATE: 14 Mar. 95

GENERATORS										FEEDERS									
TIME	UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		KILOWATT DEMAND	UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.	
	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD		AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD
	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	GEN	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR
2400									2400										
0100									2400										
0200									2400										
0300									2400										
0400									2400										
0500									2400										
0600									2400										
0700									2400										
0800									2400										
0900									2400										
1000									2400										
1100									2400										
1200									2400										
1300									2400										
1400									2400										
1500									2400										
1600									2400										
1700									2400										
1800									2400										
1900									2400										
2000									2400										
2100									2400										
2200									2400										
2300									2400										
TOTAL																			

MIDNIGHT OPERATOR

DAY OPERATOR

AFTERNOON OPERATOR

PREVIOUS EDITION IS OBSOLETE

INSTALLATION: FORT GREELY, AK. ELECTRIC POWER PLANT OPERATING LOG ELECTRICAL GENERATION AND DISTRIBUTION LOG DATE: 23 JUL 95

GENERATORS										FEEDERS										TOTAL		
TIME	UNIT NO.	LOAD KW	AC P.F.	TEMP	UNIT NO.	LOAD KW	AC P.F.	TEMP	UNIT NO.	LOAD KW	AC P.F.	TEMP	UNIT NO.	LOAD KW	AC P.F.	TEMP	UNIT NO.	LOAD KW	AC P.F.	TEMP	KVAR IN	KVAR OUT
2400																						
0100																						
0200																						
0300																						
0400																						
0500																						
0600																						
0700																						
0800																						
0900																						
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2200																						
2300																						
2400	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	GEN 6	GEN 7	GEN 8	GEN 9	GEN 10	GEN 11	GEN 12	GEN 13	GEN 14	GEN 15	GEN 16	GEN 17	GEN 18	GEN 19	GEN 20	GEN 21	GEN 22
2400	05436	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500	05241	91789	17937	42608	13198	0829	9257	9621	4363	2158	6192											
TOTAL	95	-	-	-	-	-	1	8	-	53	-	22										

DAY OPERATOR: Null

MIDNIGHT OPERATOR: Zach

AFTERNOON OPERATOR: Null

INSTALLATION: FORT GREENLY, AK.

ELECTRIC POWER PLANT OPERATING LOG

DATE: 27 Jan 68

GENERATORS										FEEDERS										TOTAL	
UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.			
TIME	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP	LOAD KW	AC P.F.	TEMP
2400																					
0100																					
0200																					
0300																					
0400																					
0500																					
0600																					
0700																					
0800																					
0900																					
1000																					
1100																					
1200																					
1300																					
1400																					
1500																					
1600																					
1700																					
1800																					
1900																					
2000																					
2100																					
2200																					
2300																					
TOTAL																					

TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	SMIA	STATUS	G	V	E	A	KVAR	FEEDER 1	FEEDER 2	FEEDER 3	FEEDER 4	FEEDER 5	FEEDER 6	FEEDER 7	FEEDER 8	FEEDER 9	TOTAL
2400	91614	42160	—	—	—	—	9043	—	3051	—	5045	2141	63703	59770	8788	14024	73826	7477	4305	8464	—	7568
0000	05337	91530	17837	44457	12621	08223	9034	9627	5005	2158	5165	26233	63660	54750	8761	65993	73806	7407	4234	3458	—	7504
TOTAL	—	34	—	113	—	—	9	—	48	—	20	8	35	20	27	31	20	70	81	16	—	54

PREVIOUS EDITION IS OBSOLETE.

DAY OPERATOR: R. Smith

MIDNIGHT OPERATOR: [Signature]

AFTERNOON OPERATOR: [Signature]

DATE: 7 DEC 94

ELECTRICAL GENERATION AND DISTRIBUTION LOGS

INSTALLATION:

GENERATORS

[illegible]

Benson
MIDNIGHT OPERATOR

Benar
Benar
DAY OPERATOR

AFRAGON OPERATOR

FD-302 (Rev. 11-27-60)

PREVIOUS EDITION IS OBSOLETE

ELECTRIC POWER PLANT OPERATING LOG

DATE: 20 Nov 94

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG

GENERATORS										FEEDERS									
UNIT NO.	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	UNIT NO.	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR
TIME	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	TIME	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR	AC P.F.	LOAD KW	LOAD KVAR
2400										2400									
0100										0100									
0200										0200									
0300										0300									
0400										0400									
0500										0500									
0600										0600									
0700										0700									
0800										0800									
0900										0900									
1000										1000									
1100										1100									
1200										1200									
1300										1300									
1400										1400									
1500										1500									
1600										1600									
1700										1700									
1800										1800									
1900										1900									
2000										2000									
2100										2100									
2200										2200									
2300										2300									
TOTAL										TOTAL									

DAY OPERATOR

[Signature]

AFTERNOON OPERATOR

[Signature]

INSTALLATION: **FORT GREELY, AK.** **ELECTRIC POWER PLANT OPERATING LOG** **ELECTRICAL GENERATION AND DISTRIBUTION LOG**

DATE: 27 OCT 94

GENERATORS										FEEDERS									
UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.		UNIT NO.	
LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.	LOAD	AC P.F.
KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR	KW	KVAR
AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%	AMP	%
TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	GEN 6	GEN 7	GEN 8	GEN 9	GEN 10	GEN 11	GEN 12	GEN 13	GEN 14	GEN 15	GEN 16	GEN 17	GEN 18	GEN 19
2400																			
0100																			
0200																			
0300																			
0400																			
0500																			
0600																			
0700																			
0800																			
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1700																			
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2000																			
2100																			
2200																			
2300																			
TIME	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	GEN 6	GEN 7	GEN 8	GEN 9	GEN 10	GEN 11	GEN 12	GEN 13	GEN 14	GEN 15	GEN 16	GEN 17	GEN 18	GEN 19
2400																			
0100																			
0200																			
0300																			
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0500																			
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1500																			
1600																			
1700																			
1800																			
1900																			
2000																			
2100																			
2200																			
2300																			
TOTAL																			

DAY OPERATOR

NIGHT OPERATOR

AFTERNOON OPERATOR

ELECTRIC POWER PLANT OPERATING LOG

DATE: 14 SEPT 94

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG

GENERATORS										FEEDERS										TOTALS	
TIME	UNIT NO. #1	UNIT NO. #2	UNIT NO. #3	UNIT NO. #4	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW	LOAD KW
	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.	AC P.F.
	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %	AMP %
	GEN 1	GEN 2	GEN 3	GEN 4	GEN 5	GEN 6	GEN 7	GEN 8	GEN 9	GEN 10	GEN 11	GEN 12	GEN 13	GEN 14	GEN 15	GEN 16	GEN 17	GEN 18	GEN 19	GEN 20	GEN 21
2400																					
0100																					
0200																					
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2200																					
2300																					
TOTAL																					

DAY OPERATOR

MIDNIGHT OPERATOR

AFTERNOON OPERATOR

DATE: 29 AUG 94

ELECTRIC POWER PLANT OPERATING LOG

INSTALLATION: FORT GREELY, AK. ELECTRICAL GENERATION AND DISTRIBUTION LOG

GENERATORS												FEEDERS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
TIME	UNIT NO. 1			UNIT NO. 2			UNIT NO. 3			UNIT NO. 4			UNIT NO. 5			UNIT NO. 6			UNIT NO. 7			UNIT NO. 8			UNIT NO. 9			UNIT NO. 10			TOTALS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %	LOAD KW	P.F.	AMP %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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DAY OPERATOR

[Signature]

MIDNIGHT OPERATOR

[Signature]

AFTERNOON OPERATOR

[Signature]

ELECTRICAL GENERATION AND DISTRIBUTION LOG

DATE: 21 JULY 1974[illegible]

Benson
DAY OPERATOR

De Vries
MIDNIGHT OPERATOR

AFTERNOON OPERATOR

PREVIOUS EDITION IS OBSOLETE

17-20 BDE FORM 2-6
1 JUL 65

ELECTRIC

OPERATING LOG

JULY 95

DAY MONTH 19

POSITION

OPERATORS

12-8 SHIFT

8-4 SHIFT

4-12 SHIFT

ENGINES	PRESENT	ON HRS	HRS SIN
1	72805	71652	1153
2	83684	77849	5835
3	86043	77002	9041
4	55735.4	49188	6547.4
5	50657.6	46787	3870.6

DATE TIME (Hour)

ENTRIES

FEEDERS

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL	No	MULT	PRES	PREV	DIFF
1 X 100	05665	05665	0	0	1	100	67870	67431	43900
2 X 100	92060	92046	14	1400	2	100	69202	68328	87400
3 X 100	18024	18019	5	500	3	100	76163	75860	30300
4 X 114.3	43164	43096	68	7772.4	4	100	3123	2522	60100
5 X 114.3	13546	13527	19	2,171.7	5	100	61796	61591	20500
ENGINE PRESENT	PREVIOUS	RUN	STDBY		7	100	6275	5297	97800
1	72805	72805	0	744	8	100	5831	4222	160900
2	83684	83682	2	742	9	100	0479	0212	26700
3	86043.5	86043	0.5	744	SS/1	100	0304	0140	16400
4	55735.4	55722.5	12.9	731.1	SS/2	100	9545	9564	-1900
5	50657.6	50653.7	3.9	740.1	SH	100	0002	0002	0
					SM	300	0831	0831	0

↑ HOURS
↓ HOURS

METERS

	PRESENT	PREVIOUS	DIFF	TOTAL	TOTAL	1000	5685	4612	1073,000
GVEA POLEX 1	4093	3857	236	566,400					
KwHr d X	8951	8502	449	1,077,600					
KwHr r 4	0	0	0	0					
KwHr d 0	4199	3956	243	583,200					
Kvar r	0	0	0	0					
G BOARD IN X1000	0977	9901	1076	1076,000	1-2-3	986963	986681	282	
V BOARD OUT X1000	2158	2158	0	0	4-5	317310	316370	940	

TOTAL → 1,222

MAX KW TIME DATE

POST 2256 1500 5 JULY 1995

ENGINE OIL USED

GVEA 2200 1800 5 JULY 1995

1 2 3 4 5 TOTAL

PEAK KW DEMAND IN .91 X 2400 = 2184

ENGINE DAYS RUN

#3 DG P/L for GEAR REPAIRS 26 July 95

1 2 4 7 3 17DA

HEATING DEGREE DAYS
OPERATOR GIBSON

REVIEWED - Signature of Supervisor

REVIEWED - Signature of Supervisor

ELECTRIC

OPERATING LOG

JUNE 95

DAY _____ MONTH _____ 19____

POSITION	OPERATORS		
	12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINES PRESENT	Q/H HRS	HRS SINCE	
1	72805	71652	1153
2	83682	77849	5833
3	86043	77002	9041
4	55722.5	49188	6534.5
5	50653.7	46787	3866.7

DATE¹ TIME (Hour) ENTRIES FEEDERS

ENGINE KW METERS					No	MULT	PRES	PREV	DIFF	
MULT	PRESENT	PREVIOUS	DIFF	TOTAL	1	100	67431	66968	46300	
1 X 100	05665	05634	31	3100	2	100	68328	67444	88400	
2 X 100	92046	92022	24	2400	3	100	75860	75540	32000	
3 X 100	18019	18003	6	600	4	100	2522	1185	133700	
4 X 114.3	43096	43076	20	2286.0	5	100	61591	61387	20400	
5 X 114.3	13527	13478	49	5600.7	7	100	5297	4287	101000	
ENGINE	PRESENT	PREVIOUS	RUN	STDBY	8	100	4222	2631	159100	
↑ HOURS ↓	1	72805	72801	4	716	9	100	0212	9965	24700
	2	83682	83677	5	715	SS/1	100	0140	9966	17400
	3	86043	86040	3	717	SS/2	100	9564	9581	-1700
	4	55722.5	55719.5	3	717	Q/H	100	0002	0002	0
	5	50653.7	50647.2	6.5	713.5	SM	300	0831	0831	0
METERS	PRESENT	PREVIOUS	DIFF	TOTAL	TOTAL	1000	4612	3521	1091000	
A P/EX 1	3857	3632	205	492,000						
Kwhr d. 2	8502	8045	457	1,096,800						
Kwhr r. 4	0	0	0	0						
Kwhr d. 8	3956	3715	241	578,400						
Kvar	0	0	0	0						
BO FROM IN	9901	8806	1095	1095,000	FUEL PRESENT PREVIOUS USED					
X1000					1-2-3	986681	986080	601		
BOARD OUT	2158	2158	0	0	4-5	316370	316020	350		
X1000									TOTAL → 951	

MAX KW	TIME	DATE	ENGINE OIL USED					
POST 2256	1200	6/23	1	2	3	4	5	TOTAL
Q/H 2200	1400	6/28	1	1	0	1	0	3 GAL
PEAK KW DEMAND IN .99 X 2400 = 2376			ENGINE DAYS RUN					
			2	5	4	1	2	14 DAYS

HEATING DEGREE DAYS 246
OPERATOR: GIBSON

For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

[illegible]

ELECTRIC

OPERATING LOG

FEB

DAY MONTH 19 95

POSITION	OPERATORS		
	12-3 SHIFT	3-4 SHIFT	4-12 SHIFT
ENGINES	PRES	1/H	HOURS
1	72777	71652	1125
2	83655	77849	5806
3	86033	77002	9031
4	55657.7	49188	6469
5	50607	46787	3820

DATE TIME (Hour)

ENTRIES

FEEDERS

ENGINE	KW METERS				#	MULT	PRES	PREV.	TOTAL
MULT	PRES	PREVIOUS	DIFF	TOTAL					
1 X 100	05436	05241	195	19500	2	100	64921	64135	78600
2 X 100	91860	91614	246	24600	3	100	64644	63820	84400
3 X 100	17937	17937	0	0	4	100	74342	73891	45100
4 X 114.3	42685	42182	503	57492.9	5	100	9655	8892	76300
5 X 114.3	13262	12714	548	62636.4	7	100	60366	59841	46500
ENGINE	PRES	PREVIOUS	MIN	STANDEY	8	100	9681	7756	192500
1	72777	72754	23	649	9	100	6751	4626	212500
2	83655	83626	29	643	9/1	100	8922	8251	67100
3	86033	86033	0	0 1/2	9/2	100	9368	9079	22900
4	55657.7	55595.2	62.5	609.5	9/2	100	9619	9626	700
5	50607.2	50536.6	70.6	601.4	9/2	100	0002	0002	0
METER	PRES	PREVIOUS	DIFF	TOTAL	SHIA	300	0830	0828	600
1	2937	2723	214	513600	TOT	1000	9343	7792	1551000
2	6321	5731	590	1416000					
3	0	0	0	0					
4	2920	2676	244	585600					
5	0	0	0	0					
6	4672	3258	1414	1414000	TEL	PRES	PREVIOUS	TOTAL	
7	2158	2158	0	0	123	982674	979345	3329	
					45	310050	300380	9670	
									GRAND TOTAL 12999

MAX	KW	TIME	DATE
EXT	3216	1100	HRS ON 23 Feb 95
OVER	2784	0800	HRS ON 7 Feb 95
MAX KW	DEMAND IN 1.18	X 2400 =	2832
MAX KW	DEMAND IN 0	X 2400 =	0
MAX KW	DEMAND OUT 0	X 2400 =	0
MAX KW	DEMAND OUT 0	X 2400 =	0

ENGINE OIL USED

1	2	3	4	5	TOTAL
3	3.5	-	6.5	23	36

ENGINE DAYS RAN

3.4.0.6.6.19

DEGREE DRILL 1701

0 PERMANENT: Zachgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

ELECTRIC OPERATING LOG JAN		HOURS POSITION	OPERATORS		
			12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
DAY _____ MONTH _____ 19 <u>95</u>		ENGINES	PRESENT	CH HOURS	HRS SINCE CH
		1	72754	71652	1102
		2	83626	77849	5777
		3	86033	77002	9031
		4	55595.2	49188	6407.2
		5	50536.6	46787	3749.6

DATE	TIME (Hour)	ENTRIES				FEEDERS			
ENGINE	KW	METERS	#	MULT	PRES	PREV	TOTAL		
MULT PRESENT PREVIOUS DIFF TOTAL			1	100	64135	63234	90100		
1 X 100 05241 65093 148 14800			2	100	63820	62842	92800		
2 X 100 91614 91530 84 8400			3	100	73891	73351	54000		
3 X 100 17937 17937 0 0			4	100	8892	8067	82500		
4 X 114.3 42182 41292 890 101022			5	100	59841	59328	51300		
5 X 114.3 12714 11897 817 93883			7	100	7756	5508	224800		
ENGINE PRESENT PREVIOUS RUN STANDBY			8	100	4626	2218	240800		
1 72754 72737 17 727			9	100	8521	8065	45600		
2 83626 83615 11 733			S/1	100	9079	8812	26700		
3 86033 86033 0 A/L			S/2	100	9626	9634	800		
4 55595.2 55485.3 109.9 639.1			CH	100	0002	0002	0		
5 50536.6 50440.9 95.7 648.3			SNIA	300	0828	0826	600		
			TOT	1000	7792	6028	1,764,000		
METER PRESENT PREVIOUS DIFF TOTAL									
GEA 2723 2484 239 239									
SWAR 5731 5075 656 1,574,400									
SWAR 0 0 0 0									
KVAR 2676 2405 271 650,400									
KVAR 0 0 0 0									
CHORDIN 3258 1685 1573 1,573,000			1,23		979345	977721	1624		
V CHORDIN 2158 2158 0 0			4,5		300380	284950	15430		
GRAND TOTAL → 17054									

MAX KW @ TIME DATE	2408 @ 1200 HRS ON 27 JAN
POST	2900 @ 0800 HRS ON 6 JAN
PEAK KW DEMAND IN 1.12 X 2400 = 2688	ENGINE OIL USED
PEAK KVAR DEMAND IN 0 X 2400 = 0	1 2 3 4 5 TOTAL
PEAK KW DEMAND OUT 0 X 2400 = 0	2.5 1.5 0.4 68 11 83
PEAK KVAR DEMAND OUT 0 X 2400 = 0	ENGINE DAYS RAN
#2 Down for water leak #6 cyl	2 2 0 10 8 22
#3 Down for cylinder/piston repair	DEGREE DAYS: 1984
	OPERATOR: Zachgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

ELECTRIC

OPERATING LOG

DEC

DAY MONTH 19

94

POSITION

OPERATORS

12-8 SHIFT

8-4 SHIFT

ENGINES

PRESENT

OH HOURS

HRS SINCE

1
2
3
4
5

72737
83615
86033
55485.3
50440.9

71652
77849
77002
49188
46787

1085
5766
9031
6297.3
3653.9

DATE

TIME (Hour)

ENTRIES

FEEDERS

ENGINE

KW METERS

MULT

PRESENT PREVIOUS

DIFF

TOTAL

#

MULT

PREV.

PREV.

TOTAL

1 X 100

05093

04648

445

445.00

2

100

62324

62324

980.00

2 X 100

91530

91120

410

410.00

3

100

62892

61949

943.00

3 X 100

17937

17937

0

0

4

100

8067

7224

843.00

4 X 114.3

41292

40863

429

49034.7

5

100

59328

58812

516.00

5 X 114.3

11897

11212

685

78255.5

7

100

5508

3156

2352.00

ENGINE

PRESENT PREVIOUS

RUN

STANDBY

8

100

2213

9676

2537.00

1

72737

72686

51

693

9

100

8065

7605

460.00

2

83615

83569

46

698

10

100

8812

8522

290.00

3

86033

86033

-0-

-0-

11

100

9634

9640

6.00

4

55485.3

55431.3

540

690

12

100

0002

0002

-0-

5

50440.9

50352.5

83.4

660.6

13

300

0826

0824

600

SMIA

TOT

1000

6028

4228

1800.000

METER

PRESENT PREVIOUS

DIFF

TOTAL

1

2484

2244

240

240

GVA

5075

4401

674

16176.00

KVAR

0

0

0

0

KVAR

2405

2126

279

669.600

KVAR

0

0

0

0

KVAR

1685

0068

1617

1617.000

GVA

2158

2158

0

0

VIBRATION

2158

2158

0

0

FUEL

PRESENT

PREVIOUS

TOTAL

1,23

977721

971040

6681

4,5

284950

274930

10020

GRAND TOTAL -> 16701

MAX

KW @ TIME DATE

POST

3456 @ 1200 HRS ON Dec. 7

GVA

2832 @ 1800 HRS ON Dec. 13

ENGINE OIL USED

1 2 3 4 5 TOTAL

50 9.5 0 4 11 73.5

PEAK KW

DEMAND IN 1.19 X 2400 = 2856

PEAK KVAR

DEMAND IN NA X 2400 = 0

PEAK KW

DEMAND OUT 0 X 2400 = 0

PEAK KVAR

DEMAND OUT 0 X 2400 = 0

#3 Down for Noisy Cylinder area

DEGREE DAYS: 2192

OPERATOR: J. Benson

NOTE - Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

For operations requiring small number daily entries use one sheet for

ELECTRIC

OPERATING LOG

Nov

DAY MONTH 19 94

POSITION	OPERATORS		
	12-8 SHIFT	8-4 SHIFT	4-12 SHIFT
ENGINEER			
1	72686	71652	1034
2	83569	72849	5720
3	86033	72002	9031
4	55431.3	49188.0	6243.3
5	50357.5	46787.0	3570.5

DATE	TIME (Hour)	ENTRIES			FEE DEFS			
ENGINE	KV METER	#	MULT	KVA	KWH	TOTAL		
M&T	RESULT REVISION DIFF TOTAL	1	100	62354	61512	84200		
1	04648 04465 183 18300	2	100	61449	61022	92700		
2	91120 90747 373 37300	3	100	72821	72322	49900		
3	17937 17743 194 19400	4	100	7224	6488	73900		
4	40863 40737 126 14401.8	5	100	58812	58338	47400		
5	11212 11067 145 16573.5	7	100	3156	1288	186800		
6	72686 72664 22 698	7	100	9676	7376	230000		
1	83569 83525 44 676	7	100	7605	7186	41900		
2	86033 86011 22 698	7	100	8522	8253	26900		
3	55431.3 55416.9 14.4 705.6	7	100	9640	9649	900		
4	50357.5 50337.6 19.9 700.1	7	100	0002	0002	0		
5		7	100	0824	0822	600		
6		7	100	4228	2602	162600		
7		7	100					
8		7	100					
9		7	100					
10		7	100					
11		7	100					
12		7	100					
13		7	100					
14		7	100					
15		7	100					
16		7	100					
17		7	100					
18		7	100					
19		7	100					
20		7	100					
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32		7	100					
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36		7	100					
37		7	100					
38		7	100					
39		7	100					
40		7	100					
41		7	100					
42		7	100					
43		7	100					
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45		7	100					
46		7	100					
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48		7	100					
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67		7	100					
68		7	100					
69		7	100					
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73		7	100					
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86		7	100					
87		7	100					
88		7	100					
89		7	100					
90		7	100					
91		7	100					
92		7	100					
93		7	100					
94		7	100					
95		7	100					
96		7	100					
97		7	100					
98		7	100					
99		7	100					
100		7	100					

TOTAL → 8147

MAX KW TIME DATE

3360 1200 IN Nov 30th

2880 1800 IN Nov 22nd

114800 IN 1.07 X 2400 = 2568

114800 IN NA X 2400 = 0

114800 IN 0 X 2400 = 0

114800 IN 0 X 2400 = 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
22.5	5	1.5	3.5	3	35.5 gal

* EXCEPT REPLACED #4 DG

* #3D/L 30 Nov for Maint.

DETECTIVE DAVIS 1940

OPERATOR: T. Zachgo

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

For operations requiring small number daily entries use one sheet for each day and insert dates in this column.

ELECTRIC

OPERATING LOG

OCT

DAY MONTH YEAR 94

POSITION

OPERATORS

12-3 SHIFT

3-4 SHIFT

4-12 SHIFT

ENGINES

PRESENT HRS

PREVIOUS HRS

HRS SINCE

1
2
3
4
5

72664
83525
86011
55416.9
50337.6

71652
77849
77002
49188.0
46787.0

1012
5676
9009
6228.9
3550.6

DATE TIME (Hour)

ENTRIES

FEEDEES

ENGINE KW METERS

MULT	PRESENT	PREVIOUS	DIFF	TOTAL
1 X 100	04465	04388	77	7700
2 X 100	90747	90745	2	200
3 X 100	17743	17696	47	4700
4 X 114.3	46737	40663	74	8458.2
5 X 114.3	11067	10971	96	10972.8

ENGINE	PRESENT	PREVIOUS	RUN	STANDBY
1	72664	72654	10	734
2	83525	83525	0	744
3	86011	86006	5	739
4	55416.9	55,407.1	9.8	734.2
5	50337.6	50,325.3	12.3	731.7

METER	PRESENT	PREVIOUS	DIFF	TOTAL
GVEA PEX 1	2017	1784	233	559200
Kwhr d	3756	3166	590	1416000
Kwhr r	0	0	0	0
Kvar d	1859	1589	270	648000
Kvar r	0	0	0	0
G BOARD X 1000	859	7109	1410	1410000
V BOARD X 1000	2158	2158	0	0

#	MULT	PRESENT	PREVIOUS	TOTAL
1	100	61512	60779	73300
2	100	61022	60089	93300
3	100	72322	71905	41700
4	100	6485	5802	68300
5	100	58338	57987	35100
7	100	1288	9733	155500
8	100	7378	5299	207700
9	100	7186	6821	36500
55/1	100	8253	8002	25100
55/2	100	9649	9660	1100
0A	100	0002	0002	0
5MIA	300	0822	0820	600
TOT	1000	2602	1182	1420000

FUEL	PRESENT	PREVIOUS	USED
1,2,3	965,153	964,167	986
4,5	272,670	271,310	1360
TOTAL			2346

MAX KW TIME DATE

POST 2736 at 0900 Hrs ON 27 Oct 94

GVEA 2736 at 1200 hrs ON 31 Oct 94

PEAK KW DEMAND IN 1.15 X 2400 = 2760

PEAK KVAR DEMAND IN 0 X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

PEAK KVAR DEMAND OUT 0 X 2400 = 0

ENGINE OIL USED

1	2	3	4	5	TOTAL
.5	0	1	2	1	4.5

DEGREE DAYS: 1337

OPERATOR: J. Zachgo

NOTE: For all entries in this log, line out and initial all errors.

REVIEWED (Signature of Supervisor or Engineer)

<div style="font-size: 2em; font-weight: bold;">ELECTRIC</div> <div style="font-weight: bold;">OPERATING LOG</div> <div style="font-size: 2em; font-weight: bold;">AUG.</div> <div style="font-size: 2em; font-weight: bold;">94</div>					POSITION	OPERATORS				
						12-8 SHIFT	8-4 SHIFT	4-12 SHIFT		
					ENGINES	PRESENT	O/A	HOURS	HRS SINCE O/A	
					1	72653		71652	1001	
					2	83522		77849	5673	
					3	86000		77002	8998	
					4	55,403.0		49188.0	6215	
					5	50,317.8		46787.0	3530.8	
DAY _____ MONTH _____ 19__										
DATE ¹	TIME (Hour)	ENTRIES FEEDERS								
ENGINE	KW METERS				#	MULT	PRESENT	PREVIOUS	TOTAL	
MULT.	PRESENT	PREVIOUS	DIFF.	TOTAL						
1 x 100	04374	04347	27	2700	2	100	59179	59670	50,900	
2 x 100	90724	90724	0	0	3	100	71546	71188	35,800	
3 x 100	17647	17628	19	1900	4	100	5212	4626	58,600	
4 x 114.3	40634	40593	41	4686.3	5	100	57732	57513	21,900	
5 x 114.3	10915	10874	41	4686.3	7	100	8544	7424	112,000	
ENGINE	PRESENT	PREVIOUS	RUN	STAND BY	8	100	3533	1919	161,400	
1	72653	72649	4	740	9	100	6511	6261	25,000	
2	83522	83522	0	744	SS/1	100	7821	7650	17,100	
3	86000	85998	2	742	SS/2	100	9671	9695	2,400	
4	55,403.0	55397.7	5.3	738.7	OIL TIE	100	0002	0002	0	
5	50,317.8	50311.5	6.3	737.7	SMIA	300	0817	0817	0	
METERS	PRESENT	PREVIOUS	DIFF.	TOTAL	TOT	1000	9984	8852	1,132,000	
WATER PUMP	1561	1326	235	235						
KWH d	2666	2192	474	1,137,600						
KWH r	0	0	0	0						
WATER d	1336	1090	246	590,400						
WATER r	0	0	0	0						
G BUA D	5910	4775	1135	1,135,000	1,3,3	963534	963252	282		
V BUA D	2158	2158	0	0	4,5	270630	270190	440		
									TOTAL → 722	
MAX KW TIME DATE										
POST	2256	at 1200	HRS ON	29 AUG.	ENGINE OIL USED					
GUEA	2280	at 1400	HRS ON	18 AUG.	1	2	3	4	5	TOTAL
PEAK KW DEMAND IN	.95	X 2400 =	2280		1			1/2		1 1/2
PEAK KW DEMAND IN	0	X 2400 =								
PEAK KW DEMAND OUT	0	X 2400 =								
PEAK KW DEMAND OUT	0	X 2400 =								
DEGREE DAYS 273										
OPERATOR : B. Goodno										

NOTE—Make all entries in ink. Line out and initial all errors.

¹ For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

REVIEWED (Signature of Supervisor in Charge)

ELECTRIC

OPERATING LOG

JULY

DAY _____ MONTH _____ 19 94

POSITION

ENGINES

1
2
3
4
5

OPERATORS

12-8 SHIFT

8-4 SHIFT

4-12 SHIFT

PRESENT HRS

O/H HOURS

HRS SINCE O/H

72649
83522
85998
55397.7
50311.5

71652
77849
77002
49188.0
46787.0

997
5673
8996
6209.7
3524.5

DATE¹

TIME (Hour)

ENTRIES

FEEDERS

ENGINE

KW METERS

MULT.

PRESENT

PREVIOUS

DIFF.

TOTAL

#

MULT

PRESENT

PREVIOUS

TOTAL

1

x 100

04347

04347

0

0

2

100

58219

57284

93500

2

x 100

90724

90724

0

0

3

100

71188

70900

28800

3

x 100

17628

17628

0

0

4

100

4626

4037

58900

4

x 114.3

40593

40548

45

5143.5

5

100

57513

57311

262,00

5

x 114.3

10874

10837

37

4229.1

7

100

7424

6355

106900

ENGINE

PRESENT

PREVIOUS

RUN

STAND BY

8

100

1919

0346

157300

1

72649

72649

0

744

9

100

6261

6017

24400

2

83522

83522

0

744

SS/1

100

7650

7478

17200

3

85998

85998

0

744

SS/2

100

9695

9731

-3600

4

55397.7

55391.6

6.1

737.9

O/H

100

0002

0002

0

5

50311.5

30306.7

4.8

739.2

SMH

300

0817

0817

0

METERS

PRESENT

PREVIOUS

DIFF.

TOTAL

TOT

1000

8852

7768

106600

1326

1097

229

229

2192

1736

456

1,094,400

0

0

0

0

1090

844

246

590,400

0

0

0

0

FUEL PRESENT PREVIOUS USED

4775

3684

1091

1091,000

1,2,3

963252

963250

2

2158

2158

0

0

4,5

270190

269500

690

TOTAL → 692

MAX

KW

TIME DATE

POST

2256

at 1200 HRS ON 21 JULY 94

ENGINE OIL USED

QUEA

2100

at 1600 HRS ON 21 JULY 94

1 2 3 4 5 TOTAL

PEAK KW DEMAND IN 0.91 X 2400 = 2184

0 1/2 1 2 1 1/2 5

PEAK KW DEMAND IN 0 X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

PEAK KW DEMAND OUT 0 X 2400 = 0

DEGREE DAYS 133

OPERATOR J. GIBSON

NOTE—Make all entries in ink. Line out and initial all errors.

REVIEWED (Signature of Supervisor in Charge)

¹ For operations requiring small number daily entries use one sheet for several days and insert dates in this column.

APPENDIX E

Modelling Calculations

LUMPED LOAD CALCULATIONS

The following are definitions of terms and descriptions of calculations used in the the lumped load calculations on the spreadsheets contained in this section.

Estimated Demand - This value is entered by the user. It is used to calculate the "Estimated Load Each" from the "3 Ph. Eq. KVA". It represents the percent of connected KVA to which the transformer is actually loaded.

Power Factor - All transformers are assumed to operating at a 95% power factor based upon the yearly peak load data from December 7, 1994 at 12:00 hours, AST. Since the majority of the loads on the base are lighting loads and other high power factor loads this assumption is reasonable.

Voltage - The feeder voltage.

Feeder Ampacity - The feeder ampacity is taken form the "Electric Plant Operating Log" for December 7, 1994 at 1200 hours, AST. This is the peak post load for the year and is selected because it represents the worst case loading.

Bus No. - This column contains the bus numbers served by a feeder and referenced to the one-line diagrams.

Trans No. - This column contains the transformer number as it referenced on the one-line diagram.

1 Ph, KVA - This column contains the KVA rating of the single phase transformers in the bank.

Trans. Phase - This column indicates weather the transformers in the bank are connected single phase or three phase.

3 Ph. Eq. KVA - This column contains the three phase equivalent kVA for the transformer bank depending upon it's connection. This column is necessary since the DAPPER Program cannot model single phase loads. For the purpose of this study the line currents are of most importance since they are directly responsible for the magnitude of the line losses. This column contains the "1 Ph. KVA" column times $\sqrt{3}$ for single phase transformers to simulate the single phase current that the transformer would normally draw on one phase, only on all three phases. This column contains the "1 Ph. KVA" column times 3 for the three phase transformers.

Estimated Load Each/KVA - This column contains the product of the "Estimated Demand" and the "3 Ph. Eq. KVA" columns.

Estimated Load Each/KW - This column contains the product of the "Estimated Load Each/KVA" column and the "Power Factor".

Estimated Load Each/KVAR - This column contains the square-root of the "Estimated Load Each/KVA" squared minus the "Estimated Load Each/KW" squared.

Est. Lumped Load/KW - This column contains the sum of the "Estimated Load Each/KW"s for the "Bus No." shown in the far left column. These values are entered into the DAPPER Program as special loads for the bus.

Est. Lumped Load/KVAR - This column contains the sum of the "Estimated Load Each/KVAR"s for the "Bus No." shown in the far left column. These values are entered into the DAPPER Program as special loads for the bus.

Feeder Totals - This row contains the sum of columns:

- 1 Ph. KVA
- 3 Ph. Eq. KVA
- Estimated Load Each/KVA
- Estimated Load Each/KW
- Estimated Load Each/KVAR
- Est. Lumped Load/KW
- Est. Lumped Load/KVAR

Feeder Ampacity Total - This cell contains the calculated demand amps based on the sum of the "Estimated Load Each/KVA". It is not used for any other calculations nor is it entered into the DAPPER Program. It is simply used as reference compared to the Feeder Ampacity above.

Estimate of Poles
1995 - 1997 Study

Pole Spacing	125 ft
Overhead Electric Lines	31.2 mi
Total Number of Poles	$1318 = \frac{\text{Overhead Electric Lines} * 5280}{\text{Pole Spacing}}$
Percent Bad Cross-Arms	5%
Total number of cross arms to be replaced	$66 = \text{Total Number of Poles} * \text{Percent Bad Cross-Arms}$
Total number of insulators	$3954 = \text{Total Number Poles} * 3$
Percent Bad Insulators	15%
Total number on insulators to be replaced	$594 = \text{Total Number of Insulators} * \text{Percent Bad Insulators}$
No. of Grounded poles per mile	4
Total grounded Poles:	$329 = \frac{\text{Miles} * 5280''}{\text{Pole Spacing} * \# \text{ of GND. Poles/mile}}$
#4 Ground Wire per pole	50 ft
Total length of ground conductor	16.47 mft



LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 35%
Power Factor 95%

Voltage 2,400
Feeder Ampacity 125

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
105	1-1	15	1	25.98	8.96	8.52	2.80	9	3
110	1-2	37.5	1	64.95	22.41	21.29	7.00	21	7
115	1-3	25	3	75.00	25.88	24.58	8.08	25	8
120	1-4	50	3	150.00	51.75	49.16	16.16	222	73
	1-5	50	3	150.00	51.75	49.16	16.16		
	1-6	100	1	173.21	59.76	56.77	18.66		
	1-7	75	1	129.90	44.82	42.58	13.99		
	1-8	37.5	1	64.95	22.41	21.29	7.00		
121	1-9	10	1	17.32	5.98	5.68	1.87	62	21
	1-10	25	1	43.30	14.94	14.19	4.66		
	1-11	37.5	1	64.95	22.41	21.29	7.00		
	1-12	37.5	1	64.95	22.41	21.29	7.00		
122	1-13	25	1	43.30	14.94	14.19	4.66	98	32
	1-14	10	3	30.00	10.35	9.83	3.23		
	1-15	75	3	225.00	77.63	73.74	24.24		
125	1-16	25	1	43.30	14.94	14.19	4.66	62	20
	1-17	50	1	86.60	29.88	28.38	9.33		
	1-18	5	3	15.00	5.18	4.92	1.62		
	1-19	25	1	43.30	14.94	14.19	4.66		
130	1-20	50	1	86.60	29.88	28.38	9.33	31	10
	1-21	5	1	8.66	2.99	2.84	0.93		
135	1-22	25	1	43.30	14.94	14.19	4.66	14	5
Feeder Totals		1225		1,649.59	569.11	540.65	177.70	544	179
Feeder Ampacity					136.91				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	41%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	122

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
205	2-1	15	3	45.00	18.45	17.53	5.76	69	22
	2-2	37.5	3	112.50	46.13	43.82	14.40		
210	2-3	75	3	225.00	92.25	87.64	28.81	88	29
215	2-4	75	3	225.00	92.25	87.64	28.81	88	29
220	2-5	50	3	150.00	61.50	58.43	19.20	58	19
235	2-6	37.5	3	112.50	46.13	43.82	14.40	44	14
236	2-7	75	3	225.00	92.25	87.64	28.81	88	29
240	2-8	75	3	225.00	92.25	87.64	28.81	88	29
Feeder Totals		1320		1,320.00	541.20	514.14	168.99	522	171
Feeder Ampacity					130.19				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	34%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	85

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
301	3-1	30	1	51.96	17.64	16.76	5.51	186	61
	3-2	50	3	150.00	50.93	48.38	15.90		
	3-3	50	3	150.00	50.93	48.38	15.90		
	3-4	75	3	225.00	76.39	72.57	23.85		
305	3-5	15	3	45.00	15.28	14.51	4.77	15	5
310	3-6	15	3	45.00	15.28	14.51	4.77	162	54
	3-7	15	3	45.00	15.28	14.51	4.77		
	3-8	50	3	150.00	50.93	48.38	15.90		
	3-9	0	0	0.00	0.00	0.00	0.00		
	3-10	37.5	3	112.50	38.19	36.28	11.93		
	3-11	37.5	3	112.50	38.19	36.28	11.93		
	3-12	15	1	25.98	8.82	8.38	2.75		
Feeder Totals		840		1,112.94	377.84	358.95	117.98	363	120
Feeder Ampacity					90.90				

Feeder 4

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	26%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	100

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
401	4-1	100	3	300.00	78.75	74.81	24.59	75	25
403	4-2	166.67	3	500.01	131.25	124.69	40.98	125	41
405	4-3	50	3	150.00	39.38	37.41	12.29	65	22
	4-4	37.5	3	112.50	29.53	28.05	9.22		
410	4-5	25	3	75.00	19.69	18.70	6.15	143	47
	4-6	166.67	3	500.01	131.25	124.69	40.98		
Feeder Totals		1637.52		1,637.52	429.85	408.36	134.22	408	134
Feeder Ampacity					103.41				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 11%
Power Factor 95%

Voltage 2,400
Feeder Ampacity 60

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
510	5-1	100	3	300.00	33.00	31.35	10.30	31	10
512	5-2	15	1	25.98	2.86	2.71	0.89	14	5
	5-3	37.5	3	112.50	12.38	11.76	3.86		
514	5-5	15	3	45.00	4.95	4.70	1.55	5	2
515	5-4	25	3	75.00	8.25	7.84	2.58	8	3
520	5-6	15	3	45.00	4.95	4.70	1.55	5	2
525	5-7	15	3	45.00	4.95	4.70	1.55	8	3
	5-8	10	3	30.00	3.30	3.14	1.03		
530	5-9	10	1	17.32	1.91	1.81	0.59	5	1
	5-10	15	1	25.98	2.86	2.71	0.89		
	5-11	0	0	0.00	0.00	0.00	0.00		
531	5-12	50	3	150.00	16.50	15.68	5.15	16	5
535	5-13	25	1	43.30	4.76	4.52	1.49	5	1
540	5-14	10	1	17.32	1.91	1.81	0.59	2	1
545	5-16	37.5	3	112.50	12.38	11.76	3.86	12	4
550	5-15	10	1	17.32	1.91	1.81	0.59	2	1
565	5-17	15	3	45.00	4.95	4.70	1.55	5	2
570	5-18	25	3	75.00	8.25	7.84	2.58	8	3
575	5-19	5	3	15.00	1.65	1.57	0.52	2	1
580	5-20	25	3	75.00	8.25	7.84	2.58	8	3
585	5-21	75	3	225.00	24.75	23.51	7.73	24	8
590	5-22	37.5	3	112.50	12.38	11.76	3.86	41	17
	5-23	15	3	45.00	4.95	4.70	1.55		
	5-24	37.5	3	112.50	12.38	11.76	3.86		
595	5-25	15	3	45.00	4.95	4.70	1.55	33	10
	5-26	50	3	150.00	16.50	15.68	5.15		
	5-27	15	1	25.98	2.86	2.71	0.89		
	5-28	15	1	25.98	2.86	2.71	0.89		
Feeder Totals		637.5		2,014.19	221.56	210.48	69.18	230	78
Feeder Ampacity					53.30				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	29%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	112

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
705	7-1	50	3	150.00	43.50	41.33	13.58	41	14
709	7-2	100	3	300.00	87.00	82.65	27.17	83	27
710	7-3	25	3	75.00	21.75	20.66	6.79	84	28
	7-4	25	3	75.00	21.75	20.66	6.79		
	7-5	37.5	1	64.95	18.84	17.89	5.88		
	7-6	5	3	15.00	4.35	4.13	1.36		
	7-7	25	3	75.00	21.75	20.66	6.79		
715	7-8	25	3	75.00	21.75	20.66	6.79	21	7
720	7-9	37.5	3	112.50	32.63	30.99	10.19	31	10
725	7-10	15	3	45.00	13.05	12.40	4.07	93	30
	7-11	25	3	75.00	21.75	20.66	6.79		
	7-12	25	1	43.30	12.56	11.93	3.92		
	7-13	75	1	129.90	37.67	35.79	11.76		
	7-15	25	1	43.30	12.56	11.93	3.92		
730	7-16	15	3	45.00	13.05	12.40	4.07	12	4
735	7-14	25	3	75.00	21.75	20.66	6.79	21	7
740	7-17	10	3	30.00	8.70	8.27	2.72	17	5
	7-19	10	3	30.00	8.70	8.27	2.72		
750	7-18	25	3	75.00	21.75	20.66	6.79	21	7
755	7-20	15	1	25.98	7.53	7.16	2.35	7	2
760	7-21	25	1	43.30	12.56	11.93	3.92	12	4
765	7-22	25	3	75.00	21.75	20.66	6.79	21	7
770	7-23	10	1	17.32	5.02	4.77	1.57	5	2
775	7-24	10	3	30.00	8.70	8.27	2.72	12	4
Feeder Totals		727.5		1,725.56	500.41	475.39	156.25	479	158
Feeder Ampacity					120.38				

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 26%
Power Factor 95%

Voltage 2,400
Feeder Ampacity 100

Bus No.	Trans. No.	Connected		3 Ph. Eq. KVA	Computer Model			Est. Lumped Load	
		1 Ph. KVA	Trans. Phase		Estimated Load Each KVA	KW	KVAR	KW	KVAR
805	8-1	75	1	129.90	33.77	32.09	10.55	32	11
810	8-2	15	1	25.98	6.75	6.42	2.11	77	25
	8-3	37.5	1	64.95	16.89	16.04	5.27		
	8-4	15	1	25.98	6.75	6.42	2.11		
	8-5	37.5	1	64.95	16.89	16.04	5.27		
	8-6	75	1	129.90	33.77	32.09	10.55		
815	8-7	10	1	17.32	4.50	4.28	1.41	4	1
817	8-8	15	1	25.98	6.75	6.42	2.11	48	16
	8-9	50	1	86.60	22.52	21.39	7.03		
	8-10	37.5	1	64.95	16.89	16.04	5.27		
	8-11	5	3	15.00	3.90	3.71	1.22		
820	8-12	75	1	129.90	33.77	32.09	10.55	123	40
	8-13	37.5	1	64.95	16.89	16.04	5.27		
	8-14	75	1	129.90	33.77	32.09	10.55		
	8-15	75	1	129.90	33.77	32.09	10.55		
	8-16	25	1	43.30	11.26	10.70	3.52		
825	8-17	75	1	129.90	33.77	32.09	10.55	144	47
	8-19	75	1	129.90	33.77	32.09	10.55		
	8-18	37.5	1	64.95	16.89	16.04	5.27		
	8-20	75	1	129.90	33.77	32.09	10.55		
	8-21	37.5	1	64.95	16.89	16.04	5.27		
	8-22	37.5	1	64.95	16.89	16.04	5.27		
Feeder Totals		265		1,734.06	450.86	428.31	140.78	428	141
Feeder Ampacity					108.46				

Feeder 9

LUMPED LOAD CALCULATIONS

1995 to 1997 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 25%
Power Factor 95%

Voltage 7,200
Feeder Ampacity 100 (@ 2400 V)

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
910	9-1	25	3	75.00	18.75	17.81	5.85	18	6
915	9-2	15	1	25.98	6.50	6.17	2.03	60	20
	9-3	37.5	3	112.50	28.13	26.72	8.78		
	9-4	37.5	3	112.50	28.13	26.72	8.78		
920	9-5	15	1	25.98	6.50	6.17	2.03	10	3
	9-6	10	1	17.32	4.33	4.11	1.35		
935	9-8	25	1	43.30	10.83	10.28	3.38	10	3
940	9-9	37.5	1	64.95	16.24	15.43	5.07	15	5
945	9-7	3	1	5.20	1.30	1.23	0.41	5	2
	9-10	10	1	17.32	4.33	4.11	1.35		
950	9-12	10	1	17.32	4.33	4.11	1.35	4	1
955	9-11	10	1	17.32	4.33	4.11	1.35	4	1
960	9-13	25	3	75.00	18.75	17.81	5.85	18	6
963	9-14	25	3	75.00	18.75	17.81	5.85	18	6
966	9-15	5	1	8.66	2.17	2.06	0.68	2	1
977	9-16	10	1	17.32	4.33	4.11	1.35	16	5
	9-17	10	1	17.32	4.33	4.11	1.35		
	9-18	10	1	17.32	4.33	4.11	1.35		
	9-19	10	1	17.32	4.33	4.11	1.35		
982	9-20	15	1	25.98	6.50	6.17	2.03	6	2
	9-21	0	0	0.00	0.00	0.00	0.00		
983	9-22	5	1	8.66	2.17	2.06	0.68	163	53
	9-23	15	1	25.98	6.50	6.17	2.03		
	9-24	50	3	150.00	37.50	35.63	11.71		
	9-25	166.67	3	500.01	125.00	118.75	39.03		
985	9-34	15	3	45.00	11.25	10.69	3.51	11	4
990	9-26	10	3	30.00	7.50	7.13	2.34	46	15
	9-27	37.5	3	112.50	28.13	26.72	8.78		
	9-28	15	1	25.98	6.50	6.17	2.03		
	9-29	15	1	25.98	6.50	6.17	2.03		
995	9-30	50	3	150.00	37.50	35.63	11.71	46	15
	9-31	15	3	45.00	11.25	10.69	3.51		
997	9-32	25	3	75.00	18.75	17.81	5.85	24	8
	9-33	15	1	25.98	6.50	6.17	2.03		
Feeder Totals		365		2,008.71	502.18	477.07	156.80	477	157
Feeder Ampacity					40.27	(@ 7200 V)			

Estimate of Poles
Post 2001 Study

Pole Spacing	125 ft
Overhead Electric Lines	23.1 mi
Total Number of Poles	$976 = \frac{\text{Overhead Electric Lines} * 5280}{\text{Pole Spacing}}$
Percent Bad Cross-Arms	5%
Total number of cross arms to be replaced	$49 = \text{Total Number of Poles} * \text{Percent Bad Cross-Arms}$
Total number of insulators	$2928 = \text{Total Number Poles} * 3$
Percent Bad Insulators	15%
Total number on insulators to be replaced	$440 = \text{Total Number of Insulators} * \text{Percent Bad Insulators}$
No. of Grounded poles per mile	4
Total grounded Poles:	$244 = \frac{\text{Miles} * 5280}{\text{Pole Spacing} * \# \text{ of GND. Poles/mile}}$
#4 Ground Wire per pole	50 ft
Total length of ground conductor	12.20 mft



LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 35%
Power Factor 95%

Voltage 2,400
Feeder Ampacity 125

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
105	1-1	15	1	25.98	0.00	0.00	0.00	0	0
110	1-2	37.5	1	64.95	0.00	0.00	0.00	0	0
115	1-3	25	3	75.00	0.00	0.00	0.00	0	0
120	1-4	50	3	150.00	0.00	0.00	0.00	43	14
	1-5	50	3	150.00	0.00	0.00	0.00		
	1-6	100	1	173.21	0.00	0.00	0.00		
	1-7	75	1	129.90	44.82	42.58	13.99		
	1-8	37.5	1	64.95	0.00	0.00	0.00		
121	1-9	10	1	17.32	0.00	0.00	0.00	43	14
	1-10	25	1	43.30	0.00	0.00	0.00		
	1-11	37.5	1	64.95	22.41	21.29	7.00		
	1-12	37.5	1	64.95	22.41	21.29	7.00		
122	1-13	25	1	43.30	0.00	0.00	0.00	74	24
	1-14	10	3	30.00	0.00	0.00	0.00		
	1-15	75	3	225.00	77.63	73.74	24.24		
125	1-16	25	1	43.30	0.00	0.00	0.00	0	0
	1-17	50	1	86.60	0.00	0.00	0.00		
	1-18	5	3	15.00	0.00	0.00	0.00		
	1-19	25	1	43.30	0.00	0.00	0.00		
130	1-20	50	1	86.60	0.00	0.00	0.00	0	0
	1-21	5	1	8.66	0.00	0.00	0.00		
135	1-22	25	1	43.30	0.00	0.00	0.00	0	0
Feeder Totals		1225		1,649.59	167.26	158.90	52.23	159	52
Feeder Ampacity					40.24				

Feeder 2

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	41%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	122

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
205	2-1	15	3	45.00	0.00	0.00	0.00	0	0
	2-2	37.5	3	112.50	0.00	0.00	0.00		
210	2-3	75	3	225.00	0.00	0.00	0.00	0	0
215	2-4	75	3	225.00	0.00	0.00	0.00	0	0
220	2-5	50	3	150.00	0.00	0.00	0.00	0	0
235	2-6	37.5	3	112.50	46.13	43.82	14.40	44	14
236	2-7	75	3	225.00	92.25	87.64	28.81	88	29
240	2-8	75	3	225.00	92.25	87.64	28.81	88	29
Feeder Totals		1320		1,320.00	230.63	219.09	72.01	219	72
Feeder Ampacity					55.48				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	85

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
301	3-1	30	1	51.96	0.00	0.00	0.00	0	0
	3-2	50	3	150.00	0.00	0.00	0.00		
	3-3	50	3	150.00	0.00	0.00	0.00		
	3-4	75	3	225.00	0.00	0.00	0.00		
305	3-5	15	3	45.00	0.00	0.00	0.00	0	0
310	3-6	15	3	45.00	0.00	0.00	0.00	0	0
	3-7	15	3	45.00	0.00	0.00	0.00		
	3-8	50	3	150.00	0.00	0.00	0.00		
	3-9	0	0	0.00	0.00	0.00	0.00		
	3-10	37.5	3	112.50	0.00	0.00	0.00		
	3-11	37.5	3	112.50	0.00	0.00	0.00		
	3-12	15	1	25.98	0.00	0.00	0.00		
Feeder Totals		840		1,112.94	0.00	0.00	0.00	0	0
Feeder Ampacity					0.00				

Feeder 4

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	100

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
401	4-1	100	3	300.00	0.00	0.00	0.00	0	0
403	4-2	166.67	3	500.01	0.00	0.00	0.00	0	0
405	4-3	50	3	150.00	0.00	0.00	0.00	0	0
	4-4	37.5	3	112.50	0.00	0.00	0.00		
410	4-5	25	3	75.00	0.00	0.00	0.00	0	0
	4-6	166.67	3	500.01	0.00	0.00	0.00		
Feeder Totals		1637.52		1,637.52	0.00	0.00	0.00	0	0
Feeder Ampacity					0.00				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 11%
Power Factor 95%

Voltage 2,400
Feeder Ampacity 60

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
510	5-1	100	3	300.00	0.00	0.00	0.00	0	0
512	5-2	15	1	25.98	0.00	0.00	0.00	0	0
	5-3	37.5	3	112.50	0.00	0.00	0.00		
514	5-5	15	3	45.00	0.00	0.00	0.00	0	0
515	5-4	25	3	75.00	0.00	0.00	0.00	0	0
520	5-6	15	3	45.00	0.00	0.00	0.00	0	0
525	5-7	15	3	45.00	0.00	0.00	0.00	0	0
	5-8	10	3	30.00	0.00	0.00	0.00		
530	5-9	10	1	17.32	0.00	0.00	0.00	0	0
	5-10	15	1	25.98	0.00	0.00	0.00		
	5-11	0	0	0.00	0.00	0.00	0.00		
531	5-12	50	3	150.00	0.00	0.00	0.00	0	0
535	5-13	25	1	43.30	0.00	0.00	0.00	0	0
540	5-14	10	1	17.32	0.00	0.00	0.00	0	0
545	5-16	37.5	3	112.50	0.00	0.00	0.00	0	0
550	5-15	10	1	17.32	0.00	0.00	0.00	0	0
565	5-17	15	3	45.00	0.00	0.00	0.00	0	0
570	5-18	25	3	75.00	0.00	0.00	0.00	0	0
575	5-19	5	3	15.00	0.00	0.00	0.00	0	0
580	5-20	25	3	75.00	8.25	7.84	2.58	8	3
585	5-21	75	3	225.00	0.00	0.00	0.00	0	0
590	5-22	37.5	3	112.50	0.00	0.00	0.00	0	0
	5-23	15	3	45.00	0.00	0.00	0.00		
	5-24	37.5	3	112.50	0.00	0.00	0.00		
595	5-25	15	3	45.00	0.00	0.00	0.00	0	0
	5-26	50	3	150.00	0.00	0.00	0.00		
	5-27	15	1	25.98	0.00	0.00	0.00		
	5-28	15	1	25.98	0.00	0.00	0.00		
Feeder Totals		637.5		2,014.19	8.25	7.84	2.58	8	3
Feeder Ampacity					1.98				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	29%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	112

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
705	7-1	50	3	150.00	43.50	41.33	13.58	41	14
709	7-2	100	3	300.00	87.00	82.65	27.17	83	27
710	7-3	25	3	75.00	0.00	0.00	0.00	21	7
	7-4	25	3	75.00	0.00	0.00	0.00		
	7-5	37.5	1	64.95	0.00	0.00	0.00		
	7-6	5	3	15.00	0.00	0.00	0.00		
	7-7	25	3	75.00	21.75	20.66	6.79		
715	7-8	25	3	75.00	21.75	20.66	6.79	21	7
720	7-9	37.5	3	112.50	0.00	0.00	0.00	0	0
725	7-10	15	3	45.00	0.00	0.00	0.00	0	0
	7-11	25	3	75.00	0.00	0.00	0.00		
	7-12	25	1	43.30	0.00	0.00	0.00		
	7-13	75	1	129.90	0.00	0.00	0.00		
	7-15	25	1	43.30	0.00	0.00	0.00		
730	7-16	15	3	45.00	0.00	0.00	0.00	0	0
735	7-14	25	3	75.00	0.00	0.00	0.00	0	0
740	7-17	10	3	30.00	0.00	0.00	0.00	8	3
	7-19	10	3	30.00	8.70	8.27	2.72		
750	7-18	25	3	75.00	21.75	20.66	6.79	21	7
755	7-20	15	1	25.98	0.00	0.00	0.00	0	0
760	7-21	25	1	43.30	0.00	0.00	0.00	0	0
765	7-22	25	3	75.00	0.00	0.00	0.00	0	0
770	7-23	10	1	17.32	0.00	0.00	0.00	0	0
775	7-24	10	3	30.00	0.00	0.00	0.00	0	0
Feeder Totals		727.5		1,725.56	204.45	194.23	63.84	194	64
Feeder Ampacity					49.18				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand	0%	Voltage	2,400
Power Factor	95%	Feeder Ampacity	100

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
805	8-1	75	1	129.90	0.00	0.00	0.00	0	0
810	8-2	15	1	25.98	0.00	0.00	0.00	0	0
	8-3	37.5	1	64.95	0.00	0.00	0.00		
	8-4	15	1	25.98	0.00	0.00	0.00		
	8-5	37.5	1	64.95	0.00	0.00	0.00		
	8-6	75	1	129.90	0.00	0.00	0.00		
815	8-7	10	1	17.32	0.00	0.00	0.00	0	0
817	8-8	15	1	25.98	0.00	0.00	0.00	0	0
	8-9	50	1	86.60	0.00	0.00	0.00		
	8-10	37.5	1	64.95	0.00	0.00	0.00		
	8-11	5	3	15.00	0.00	0.00	0.00		
820	8-12	75	1	129.90	0.00	0.00	0.00	0	0
	8-13	37.5	1	64.95	0.00	0.00	0.00		
	8-14	75	1	129.90	0.00	0.00	0.00		
	8-15	75	1	129.90	0.00	0.00	0.00		
	8-16	25	1	43.30	0.00	0.00	0.00		
825	8-17	75	1	129.90	0.00	0.00	0.00	0	0
	8-19	75	1	129.90	0.00	0.00	0.00		
	8-18	37.5	1	64.95	0.00	0.00	0.00		
	8-20	75	1	129.90	0.00	0.00	0.00		
	8-21	37.5	1	64.95	0.00	0.00	0.00		
	8-22	37.5	1	64.95	0.00	0.00	0.00		
Feeder Totals		265		1,734.06	0.00	0.00	0.00	0	0
Feeder Ampacity					0.00				

LUMPED LOAD CALCULATIONS

Post 2001 Study

Estimates based on actual feeder data from December 7, 1994 at 1200 AST

Estimated Demand 25%

Voltage

7,200

Power Factor 95%

Feeder Ampacity

100 (@ 2400 V)

Bus No.	Connected			3 Ph. Eq. KVA	Computer Model				
	Trans. No.	1 Ph. KVA	Trans. Phase		Estimated Load Each			Est. Lumped Load	
					KVA	KW	KVAR	KW	KVAR
910	9-1	25	3	75.00	18.75	17.81	5.85	18	6
915	9-2	15	1	25.98	0.00	0.00	0.00	0	0
	9-3	37.5	3	112.50	0.00	0.00	0.00		
	9-4	37.5	3	112.50	0.00	0.00	0.00		
920	9-5	15	1	25.98	0.00	0.00	0.00	0	0
	9-6	10	1	17.32	0.00	0.00	0.00		
935	9-8	25	1	43.30	0.00	0.00	0.00	0	0
940	9-9	37.5	1	64.95	0.00	0.00	0.00	0	0
945	9-7	3	1	5.20	0.00	0.00	0.00	4	1
	9-10	10	1	17.32	4.33	4.11	1.35		
950	9-12	10	1	17.32	0.00	0.00	0.00	0	0
955	9-11	10	1	17.32	0.00	0.00	0.00	0	0
960	9-13	25	3	75.00	0.00	0.00	0.00	0	0
963	9-14	25	3	75.00	18.75	17.81	5.85	18	6
966	9-15	5	1	8.66	0.00	0.00	0.00	0	0
977	9-16	10	1	17.32	0.00	0.00	0.00	0	0
	9-17	10	1	17.32	0.00	0.00	0.00		
	9-18	10	1	17.32	0.00	0.00	0.00		
	9-19	10	1	17.32	0.00	0.00	0.00		
982	9-20	15	1	25.98	0.00	0.00	0.00	0	0
	9-21	0	0	0.00	0.00	0.00	0.00		
983	9-22	5	1	8.66	0.00	0.00	0.00	157	51
	9-23	15	1	25.98	0.00	0.00	0.00		
	9-24	50	3	150.00	37.50	37.76	12.41		
	9-25	166.67	3	500.01	125.00	118.75	39.03		
985	9-34	15	3	45.00	0.00	0.00	0.00	0	0
990	9-26	10	3	30.00	7.50	7.13	2.34	34	11
	9-27	37.5	3	112.50	28.13	26.72	8.78		
	9-28	15	1	25.98	0.00	0.00	0.00		
	9-29	15	1	25.98	0.00	0.00	0.00		
995	9-30	50	3	150.00	0.00	0.00	0.00	0	0
	9-31	15	3	45.00	0.00	0.00	0.00		
997	9-32	25	3	75.00	18.75	17.81	5.85	24	8
	9-33	15	1	25.98	6.50	6.17	2.03		
Feeder Totals		365		2,008.71	265.20	254.08	83.51	254	84
Feeder Ampacity					21.27	(@ 7200 V)			

APPENDIX F

Load Flow Analysis - Case 1

CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 20 NOV 95
TIME: 4 50 PM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)
COPYRIGHT SKM SYSTEMS ANALYSIS, INC. 1983

DATE:20 NOV 95 TIME: 4 50 PM PAGE 2
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS
BUS NO ID STAT VOLTAGE ANGLE
=====

80	6	1	1.000	.000
----	---	---	-------	------

PV GENERATORS
BUS NO ID STAT VOLTAGE kW KVARMIN KVARMAX PARTICIPATION
=====

10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE

DATE:20 NOV 95 TIME: 4 50 PM PAGE 3
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
10 GEN G1 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
20 GEN G2 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
30 GEN G3 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
40 GEN G4 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
50 GEN G5 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	66 SM1A BLUE .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	2400.	5. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	100 FDR 1 .1050 + J	1 .0410 OHMS/M FEET	2400.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	200 FDR 2 .1050 + J	1 .0410 OHMS/M FEET	2400.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	300 FDR 3 .1050 + J	1 .0410 OHMS/M FEET	2400.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	400 FDR 4 .1050 + J	1 .0410 OHMS/M FEET	2400.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	500 FDR 5 .1050 + J	1 .0410 OHMS/M FEET	2400.	50. FT	4/0	A N XLP STATUS: EXISTING
62 SS-1 SEC IMPEDANCE:	64 MCC 4&5 .0300 + J	1 .0526 OHMS/M FEET	480.	50. FT	500	C M XLP STATUS: EXISTING
64 MCC 4&5 IMPEDANCE:	68 BLUE SSS .0300 + J	1 .0526 OHMS/M FEET	480.	50. FT	500	C M XLP STATUS: EXISTING
70 SWGR N IMPEDANCE:	90 SWGR O .0453 + J	1 .0444 OHMS/M FEET	2400.	10. FT	500	A M XLP STATUS: EXISTING

DATE:20 NOV 95 TIME: 4 50 PM PAGE 4
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
85 T1 SEC IMPEDANCE:	90 SWGR O .0453 + J	1 .0444	2400. OHMS/M FEET	10. FT	500	A M XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	600 O/H BUS .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	700 FDR 7 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	800 FDR 8 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	900 FDR 9 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
100 FDR 1 IMPEDANCE:	105 F1F12 14 .0900 + J	1 .1200	2400. OHMS/M FEET	1500. FT	4/0	A B OH-2 STATUS: EXISTING
105 F1F12 14 IMPEDANCE:	110 F1 L14 .0900 + J	1 .1200	2400. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	115 F1 L15 .0900 + J	1 .1200	2400. OHMS/M FEET	300. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	120 F1 L31 .0900 + J	1 .1200	2400. OHMS/M FEET	400. FT	4/0	A B OH-2 STATUS: EXISTING
120 F1 L31 IMPEDANCE:	121 F1 L63 .0900 + J	1 .1200	2400. OHMS/M FEET	450. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	122 F1 L64 .0900 + J	1 .1200	2400. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	125 F1 L67 .0900 + J	1 .1200	2400. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
125 F1 L67 IMPEDANCE:	130 F1 L613 .0900 + J	1 .1200	2400. OHMS/M FEET	700. FT	4/0	A B OH-2 STATUS: EXISTING
125 F1 L67 IMPEDANCE:	135 F1 L68 .0900 + J	1 .1200	2400. OHMS/M FEET	300. FT	4/0	A B OH-2 STATUS: EXISTING
200 FDR 2 IMPEDANCE:	205 .0900 + J	1 .1200	2400. OHMS/M FEET	600. FT	4/0	A B OH-2 STATUS: EXISTING

DATE:20 NOV 95 TIME: 4 50 PM PAGE 5
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
205 IMPEDANCE:	210 2-3 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	150. FT	4/0	A B OH-2 STATUS: EXISTING
205 IMPEDANCE:	235 F5 F29 .0900 + J	1 .1200 OHMS/M FEET	2400.	400. FT	4/0	A B OH-2 STATUS: EXISTING
210 2-3 PRI IMPEDANCE:	215 2-4 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	50. FT	4/0	A B OH-2 STATUS: EXISTING
215 2-4 PRI IMPEDANCE:	220 2-5 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	200. FT	4/0	A B OH-2 STATUS: EXISTING
235 F5 F29 IMPEDANCE:	236 F2 F211 .0900 + J	1 .1200 OHMS/M FEET	2400.	250. FT	4/0	A B OH-2 STATUS: EXISTING
236 F2 F211 IMPEDANCE:	240 F1 F213 .0900 + J	1 .1200 OHMS/M FEET	2400.	250. FT	4/0	A B OH-2 STATUS: EXISTING
300 FDR 3 IMPEDANCE:	301 F8 F311 .0900 + J	1 .1200 OHMS/M FEET	2400.	400. FT	4/0	A B OH-2 STATUS: EXISTING
301 F8 F311 IMPEDANCE:	303 F713 .0900 + J	1 .1200 OHMS/M FEET	2400.	200. FT	4/0	A B OH-2 STATUS: EXISTING
303 F713 IMPEDANCE:	305 F8 F311 .0900 + J	1 .1200 OHMS/M FEET	2400.	400. FT	4/0	A B OH-2 STATUS: EXISTING
305 F8 F311 IMPEDANCE:	310 F3 19 .0900 + J	1 .1200 OHMS/M FEET	2400.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
400 FDR 4 IMPEDANCE:	401 4-1 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	250. FT	4/0	A B OH-2 STATUS: EXISTING
401 4-1 PRI IMPEDANCE:	403 F1 F45 .0900 + J	1 .1200 OHMS/M FEET	2400.	250. FT	4/0	A B OH-2 STATUS: EXISTING
403 F1 F45 IMPEDANCE:	405 F4 10 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B OH-2 STATUS: EXISTING
405 F4 10 IMPEDANCE:	410 F417 UF1 .0900 + J	1 .1200 OHMS/M FEET	2400.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
500 FDR 5 IMPEDANCE:	505 F4 F5 F6UF .0900 + J	1 .1200 OHMS/M FEET	2400.	625. FT	4/0	A B OH-2 STATUS: EXISTING

DATE:20 NOV 95 TIME: 4 50 PM PAGE 6
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
505 F4 F5 F6UF IMPEDANCE:	510 5-1 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	250. FT	4/0	A B OH-2 STATUS: EXISTING
505 F4 F5 F6UF IMPEDANCE:	512 5-3 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	1600. FT	4/0	A B OH-2 STATUS: EXISTING
512 5-3 PRI IMPEDANCE:	514 5-5 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	700. FT	4/0	A B OH-2 STATUS: EXISTING
512 5-3 PRI IMPEDANCE:	515 F5 L24 .0900 + J	1 .1200 OHMS/M FEET	2400.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
515 F5 L24 IMPEDANCE:	520 5-6 PRI .6900 + J	1 .1440 OHMS/M FEET	2400.	600. FT	6	A B OH-2 STATUS: EXISTING
515 F5 L24 IMPEDANCE:	525 F5 L31 .0900 + J	1 .1200 OHMS/M FEET	2400.	200. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE:	530 F5 L39 .0900 + J	1 .1200 OHMS/M FEET	2400.	1500. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE:	531 F3 L41 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200 OHMS/M FEET	2400.	1400. FT	4/0	A B OH-2 STATUS: EXISTING
531 F3 L41 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200 OHMS/M FEET	2400.	900. FT	4/0	A B OH-2 STATUS: EXISTING
535 F537 L5 IMPEDANCE:	540 F5 L5 UF1 .0900 + J	1 .1200 OHMS/M FEET	2400.	150. FT	4/0	A B OH-2 STATUS: EXISTING
535 F537 L5 IMPEDANCE:	555 .1410 + J	1 .1250 OHMS/M FEET	2400.	800. FT	2/0	A B OH-2 STATUS: EXISTING
540 F5 L5 UF1 IMPEDANCE:	545 F5 L56 UF1 .2760 + J	1 .1320 OHMS/M FEET	2400.	2100. FT	2	A B OH-2 STATUS: EXISTING
540 F5 L5 UF1 IMPEDANCE:	550 F5 L55 .0900 + J	1 .1200 OHMS/M FEET	2400.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
555 IMPEDANCE:	560 RICH SUB .1410 + J	1 .1250 OHMS/M FEET	2400.	3200. FT	2/0	A B OH-2 STATUS: EXISTING

DATE:20 NOV 95 TIME: 4 50 PM PAGE 7
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
555 IMPEDANCE:	565 5-17 PRI .1410 + J	1 .1250 OHMS/M FEET	2400.	800. FT	2/0	A B OH-2 STATUS: EXISTING
562 RS SEC IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	7200.	5. FT	4	A B OH-2 STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	570 5-18 PRI .1410 + J	1 .1250 OHMS/M FEET	2400.	400. FT	2/0	A B OH-2 STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	575 F5 51 .1410 + J	1 .1250 OHMS/M FEET	2400.	300. FT	2/0	A B OH-2 STATUS: EXISTING
575 F5 51 IMPEDANCE:	580 F5 L85 .1410 + J	1 .1250 OHMS/M FEET	2400.	600. FT	2/0	A B OH-2 STATUS: EXISTING
580 F5 L85 IMPEDANCE:	585 F5 L87 UF1 .1410 + J	1 .1250 OHMS/M FEET	2400.	350. FT	2/0	A B OH-2 STATUS: EXISTING
580 F5 L85 IMPEDANCE:	590 F5 L8911 .4360 + J	1 .1380 OHMS/M FEET	2400.	250. FT	4	A B OH-2 STATUS: EXISTING
590 F5 L8911 IMPEDANCE:	595 F5 L8 25 .4360 + J	1 .1380 OHMS/M FEET	2400.	1150. FT	4	A B OH-2 STATUS: EXISTING
700 FDR 7 IMPEDANCE:	705 WELL9 POL .0900 + J	1 .1200 OHMS/M FEET	2400.	50. FT	4/0	A B OH-2 STATUS: EXISTING
705 WELL9 POL IMPEDANCE:	709 F9 F73 .0900 + J	1 .1200 OHMS/M FEET	2400.	200. FT	4/0	A B OH-2 STATUS: EXISTING
709 F9 F73 IMPEDANCE:	710 F7 L11 .0900 + J	1 .1200 OHMS/M FEET	2400.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE:	715 F7 L13 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE:	720 F713 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B OH-2 STATUS: EXISTING
720 F713 IMPEDANCE:	725 7-15 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
725 7-15 PRI IMPEDANCE:	730 F7 L43 .0900 + J	1 .1200 OHMS/M FEET	2400.	600. FT	4/0	A B OH-2 STATUS: EXISTING

DATE:20 NOV 95 TIME: 4 50 PM PAGE 8
CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
725 7-15 PRI IMPEDANCE:	735 F7 L54 .0900 + J	1 .1200 OHMS/M FEET	2400.	350. FT	4/0 A B OH-2 STATUS: EXISTING
735 F7 L54 IMPEDANCE:	740 7-17 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	700. FT	4/0 A B OH-2 STATUS: EXISTING
735 F7 L54 IMPEDANCE:	745 .0900 + J	1 .1200 OHMS/M FEET	2400.	625. FT	4/0 A B OH-2 STATUS: EXISTING
745 IMPEDANCE:	750 F7 L72 .0900 + J	1 .1200 OHMS/M FEET	2400.	525. FT	4/0 A B OH-2 STATUS: EXISTING
745 IMPEDANCE:	760 7-21 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	1400. FT	4/0 A B OH-2 STATUS: EXISTING
750 F7 L72 IMPEDANCE:	755 F7-33 .0900 + J	1 .1200 OHMS/M FEET	2400.	800. FT	4/0 A B OH-2 STATUS: EXISTING
760 7-21 PRI IMPEDANCE:	765 7-22 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	600. FT	4/0 A B OH-2 STATUS: EXISTING
765 7-22 PRI IMPEDANCE:	770 7-23 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	700. FT	4/0 A B OH-2 STATUS: EXISTING
770 7-23 PRI IMPEDANCE:	775 7-24 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	700. FT	4/0 A B OH-2 STATUS: EXISTING
800 FDR 8 IMPEDANCE:	805 F8 L11 .0900 + J	1 .1200 OHMS/M FEET	2400.	1800. FT	4/0 A B OH-2 STATUS: EXISTING
805 F8 L11 IMPEDANCE:	810 F8 L23 .0900 + J	1 .1200 OHMS/M FEET	2400.	1000. FT	4/0 A B OH-2 STATUS: EXISTING
810 F8 L23 IMPEDANCE:	815 F8 L25 .0900 + J	1 .1200 OHMS/M FEET	2400.	700. FT	4/0 A B OH-2 STATUS: EXISTING
810 F8 L23 IMPEDANCE:	817 F8 22 .0900 + J	1 .1200 OHMS/M FEET	2400.	200. FT	4/0 A B OH-2 STATUS: EXISTING
817 F8 22 IMPEDANCE:	820 F8 30 UF1 .0900 + J	1 .1200 OHMS/M FEET	2400.	1100. FT	4/0 A B OH-2 STATUS: EXISTING
820 F8 30 UF1 IMPEDANCE:	825 8-22 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	1700. FT	4/0 A B OH-2 STATUS: EXISTING

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
905 STEP SEC IMPEDANCE:	910 F 96 .0900 + J	1 .1200 OHMS/M FEET	7200.	600. FT	4/0	A B OH-2 STATUS: EXISTING
910 F 96 IMPEDANCE:	915 F910 .0900 + J	1 .1200 OHMS/M FEET	7200.	800. FT	4/0	A B OH-2 STATUS: EXISTING
915 F910 IMPEDANCE:	920 F940 .0900 + J	1 .1200 OHMS/M FEET	7200.	4500. FT	4/0	A B OH-2 STATUS: EXISTING
920 F940 IMPEDANCE:	945 F949 L1 .0900 + J	1 .1200 OHMS/M FEET	7200.	800. FT	4/0	A B OH-2 STATUS: EXISTING
925 () IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	7200.	1500. FT	4	A B OH-2 STATUS: EXISTING
925 () IMPEDANCE:	935 9-8 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	1000. FT	6	A B OH-2 STATUS: EXISTING
935 9-8 PRI IMPEDANCE:	940 9-9 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	5000. FT	6	A B OH-2 STATUS: EXISTING
945 F949 L1 IMPEDANCE:	950 9-12 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	2100. FT	6	A B OH-2 STATUS: EXISTING
945 F949 L1 IMPEDANCE:	960 9-13 PRI .2760 + J	1 .1320 OHMS/M FEET	7200.	2200. FT	2	A B OH-2 STATUS: EXISTING
950 9-12 PRI IMPEDANCE:	955 9-11 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	1800. FT	6	A B OH-2 STATUS: EXISTING
960 9-13 PRI IMPEDANCE:	963 9-14 PRI .2760 + J	1 .1320 OHMS/M FEET	7200.	7600. FT	2	A B OH-2 STATUS: EXISTING
963 9-14 PRI IMPEDANCE:	966 9-15 PRI .2760 + J	1 .1320 OHMS/M FEET	7200.	2200. FT	2	A B OH-2 STATUS: EXISTING
966 9-15 PRI IMPEDANCE:	969 SW UP .2760 + J	1 .1320 OHMS/M FEET	7200.	600. FT	2	A B OH-2 STATUS: EXISTING
969 SW UP IMPEDANCE:	972 SW DOWN .0300 + J	1 .0526 OHMS/M FEET	7200.	5. FT	500	C M XLP STATUS: EXISTING
972 SW DOWN IMPEDANCE:	975 9-16 PRI .2760 + J	1 .1320 OHMS/M FEET	7200.	8400. FT	2	A B OH-2 STATUS: EXISTING

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
975 9-16 PRI IMPEDANCE: .2760 + J	977 9-19 PRI .1320 OHMS/M FEET	1	7200.	10000. FT	2 A B OH-2 STATUS: EXISTING
975 9-16 PRI IMPEDANCE: .2760 + J	980 .1320 OHMS/M FEET	1	7200.	3500. FT	2 A B OH-2 STATUS: EXISTING
980 IMPEDANCE: .2760 + J	982 9-20 PRI .1320 OHMS/M FEET	1	7200.	2000. FT	2 A B OH-2 STATUS: EXISTING
980 IMPEDANCE: .2760 + J	983 9-25 PRI .1320 OHMS/M FEET	1	7200.	6000. FT	2 A B OH-2 STATUS: EXISTING
983 9-25 PRI IMPEDANCE: .2760 + J	985 9-34 PRI .1320 OHMS/M FEET	1	7200.	2000. FT	2 A B OH-2 STATUS: EXISTING
985 9-34 PRI IMPEDANCE: .2760 + J	987 .1320 OHMS/M FEET	1	7200.	6400. FT	2 A B OH-2 STATUS: EXISTING
987 IMPEDANCE: .2760 + J	990 9-26 PRI .1320 OHMS/M FEET	1	7200.	9800. FT	2 A B OH-2 STATUS: EXISTING
987 IMPEDANCE: .2760 + J	992 .1320 OHMS/M FEET	1	7200.	27000. FT	2 A B OH-2 STATUS: EXISTING
992 IMPEDANCE: .3350 + J	995 9-30 PRI .0500 OHMS/M FEET	1	7200.	25000. FT	2 A N XLP STATUS: EXISTING
992 IMPEDANCE: .2760 + J	997 9-32 PRI .1320 OHMS/M FEET	1	7200.	5000. FT	2 A B OH-2 STATUS: EXISTING

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

TRANSFORMER DATA

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
60 SWGR S IMPEDANCE:	2400. .7816 + J 4.5331	72. PERCENT	62 SS-1 SEC	480.	361.	300.0
66 SM1A BLUE IMPEDANCE:	2400. .8156 + J 4.7302	120. PERCENT	68 BLUE SSS	480.	601.	500.0
80 UTILITY IMPEDANCE:	24900. .5546 + J 5.9341	58. PERCENT	85 T1 SEC TRANSFORMER FIXED TAP:	2400.	601.	2500.0 -5.0 %
90 SWGR O IMPEDANCE:	2400. .5709 + J 3.3111	72. PERCENT	64 MCC 4&5	480.	361.	300.0
210 2-3 PRI IMPEDANCE:	2400. .9345 + J 5.4200	54. PERCENT	225 2-3 SEC	480.	271.	225.0
215 2-4 PRI IMPEDANCE:	2400. .9345 + J 5.4200	54. PERCENT	230 2-4 SEC	208.	625.	225.0
410 F417 UF1 IMPEDANCE:	2400. .9345 + J 5.4200	120. PERCENT	415 4-6 SEC	208.	1388.	500.0
545 F5 L56 UF1 IMPEDANCE:	2400. .9345 + J 5.4200	27. PERCENT	547 5-16 SEC	208.	312.	112.5
560 RICH SUB IMPEDANCE:	2400. .9345 + J 5.4200	144. PERCENT	562 RS SEC	7200.	48.	600.0
590 F5 L8911 IMPEDANCE:	2400. .9345 + J 5.4200	12. PERCENT	591 5-23 SEC	208.	139.	50.0
590 F5 L8911 IMPEDANCE:	2400. .9345 + J 5.4200	27. PERCENT	593 5-24 SEC	208.	312.	112.5
705 WELL9 POL IMPEDANCE:	2400. .9345 + J 5.4200	36. PERCENT	707 7-1 SEC	480.	180.	150.0
900 FDR 9 IMPEDANCE:	2400. .7816 + J 4.5331	361. PERCENT	905 STEP SEC	7200.	120.	1500.0
983 9-25 PRI IMPEDANCE:	7200. .9345 + J 5.4200	40. PERCENT	984 9-25 SEC	208.	1388.	500.0

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BUS SPECIAL STUDY DATA

* NO *	NAME	* KW	* KVAR	* LOAD TYPE
105	F1F12 14	9.	3.	CONSTANT Z LOAD
110	F1 L14	21.	7.	CONSTANT Z LOAD
115	F1 L15	25.	8.	CONSTANT Z LOAD
120	F1 L31	222.	73.	CONSTANT Z LOAD
121	F1 L63	62.	21.	CONSTANT Z LOAD
122	F1 L64	98.	32.	CONSTANT Z LOAD
125	F1 L67	62.	20.	CONSTANT Z LOAD
130	F1 L613	31.	10.	CONSTANT Z LOAD
135	F1 L68	14.	5.	CONSTANT Z LOAD
205		69.	22.	CONSTANT Z LOAD
210	2-3 PRI	88.	29.	CONSTANT Z LOAD
215	2-4 PRI	88.	29.	CONSTANT Z LOAD
220	2-5 PRI	58.	19.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
301	F8 F311	186.	61.	CONSTANT Z LOAD
305	F8 F311	15.	5.	CONSTANT Z LOAD
310	F3 19	162.	54.	CONSTANT Z LOAD
401	4-1 PRI	75.	25.	CONSTANT Z LOAD
403	F1 F45	125.	41.	CONSTANT KVA LOAD
405	F4 10	65.	22.	CONSTANT Z LOAD
410	F417 UF1	143.	47.	CONSTANT Z LOAD
510	5-1 PRI	31.	10.	CONSTANT Z LOAD
512	5-3 PRI	14.	5.	CONSTANT Z LOAD
514	5-5 PRI	5.	2.	CONSTANT Z LOAD
515	F5 L24	8.	3.	CONSTANT Z LOAD
520	5-6 PRI	5.	2.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
530	F5 L39	5.	2.	CONSTANT Z LOAD
531	F3 L41	16.	5.	CONSTANT Z LOAD
535	F537 L5	5.	2.	CONSTANT Z LOAD
540	F5 L5 UF1	2.	1.	CONSTANT Z LOAD
545	F5 L56 UF1	12.	4.	CONSTANT Z LOAD
550	F5 L55	2.	1.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
570	5-18 PRI	8.	3.	CONSTANT Z LOAD
575	F5 51	2.	1.	CONSTANT Z LOAD

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BUS SPECIAL STUDY DATA

* NO *	NAME	* KW	* KVAR	* LOAD TYPE
580	F5 L85	8.	3.	CONSTANT Z LOAD
585	F5 L87 UF1	24.	8.	CONSTANT Z LOAD
590	F5 L8911	41.	11.	CONSTANT Z LOAD
595	F5 L8 25	33.	10.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	84.	28.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
720	F713	31.	10.	CONSTANT Z LOAD
725	7-15 PRI	92.	30.	CONSTANT Z LOAD
730	F7 L43	12.	4.	CONSTANT Z LOAD
735	F7 L54	21.	7.	CONSTANT Z LOAD
740	7-17 PRI	17.	5.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
755	F7-33	7.	2.	CONSTANT Z LOAD
760	7-21 PRI	12.	4.	CONSTANT Z LOAD
765	7-22 PRI	21.	7.	CONSTANT Z LOAD
770	7-23 PRI	5.	2.	CONSTANT Z LOAD
775	7-24 PRI	12.	4.	CONSTANT Z LOAD
805	F8 L11	30.	10.	CONSTANT Z LOAD
810	F8 L23	73.	24.	CONSTANT Z LOAD
815	F8 L25	4.	1.	CONSTANT Z LOAD
817	F8 22	44.	15.	CONSTANT Z LOAD
820	F8 30 UF1	116.	38.	CONSTANT Z LOAD
825	8-22 PRI	136.	45.	CONSTANT KVA LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
915	F910	60.	20.	CONSTANT Z LOAD
920	F940	10.	3.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	5.	2.	CONSTANT Z LOAD
950	9-12 PRI	4.	1.	CONSTANT Z LOAD
955	9-11 PRI	4.	1.	CONSTANT Z LOAD
960	9-13 PRI	18.	6.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
966	9-15 PRI	2.	1.	CONSTANT Z LOAD
977	9-19 PRI	16.	5.	CONSTANT Z LOAD
982	9-20 PRI	6.	2.	CONSTANT Z LOAD

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E M C ENGINEERS, INC. - DENVER, COLORADO

B U S S P E C I A L S T U D Y D A T A

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=====
* NO * NAME      * KW * KVAR * LOAD TYPE
=====
983 9-25 PRI      163.   53.  CONSTANT Z  LOAD
985 9-34 PRI       11.    4.  CONSTANT Z  LOAD
990 9-26 PRI       46.   15.  CONSTANT Z  LOAD
995 9-30 PRI       46.   15.  CONSTANT Z  LOAD
997 9-32 PRI       21.    7.  CONSTANT Z  LOAD
=====
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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

*** SOLUTION COMMENTS ***
=====

SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS:	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 463

LARGEST LOAD:	1000.00 KVA	
CONVERGENCE CRITERIA:	.050 KVA	
LARGEST BUS MISMATCH	10 GEN G1	36.344 KVA
LARGEST BUS MISMATCH	10 GEN G1	.878 KVA
LARGEST BUS MISMATCH	10 GEN G1	.013 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)

BUS VOLTS(PU) ANGLE KW KVAR VD% R + JX (PU)
80 1.000 .00 2480.4 1361.5 .0

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)

BUS NAME	ID	---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
		SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.018	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.018	.0	.0	.0	.0
30 GEN G3	3	1.000	1.018	.0	.0	.0	.0
40 GEN G4	4	1.000	1.018	.0	.0	.0	.0
50 GEN G5	5	1.000	1.018	.0	.0	.0	.0

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 10 GEN G1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2443 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
 ** PV TYPE GENERATOR: 1 1000.0 KW .0 KVAR

LOAD TO: 60 SWGR S FEEDER AMPS: 236 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 1000.0 KW .0 KVAR 1000.0 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

==== BUS: 20 GEN G2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
 ** PV TYPE GENERATOR: 2 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

==== BUS: 30 GEN G3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
 ** PV TYPE GENERATOR: 3 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

==== BUS: 40 GEN G4 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
 ** PV TYPE GENERATOR: 4 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

==== BUS: 50 GEN G5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
 ** PV TYPE GENERATOR: 5 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

==== BUS: 60 SWGR S DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD FROM: 10 GEN G1 FEEDER AMPS: 236 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 999.7 KW -.4 KVAR 999.7 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

LOAD FROM: 20 GEN G2 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD FROM: 30 GEN G3 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 62 SS-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .5 KVA PF: .45 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 66 SM1A BLUE FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 70 SWGR N FEEDER AMPS: 317 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1130.1 KW 724.2 KVAR 1342.2 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 100 FDR 1 FEEDER AMPS: 136 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 545.0 KW 189.7 KVAR 577.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 200 FDR 2 FEEDER AMPS: 133 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 535.5 KW 178.7 KVAR 564.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 300 FDR 3 FEEDER AMPS: 93 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 372.8 KW 125.1 KVAR 393.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 400 FDR 4 FEEDER AMPS: 104 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 415.9 KW 139.6 KVAR 438.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 500 FDR 5 FEEDER AMPS: 65 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 261.2 KW 91.7 KVAR 276.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 62 SS-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD TO: 60 SWGR S TRANSF AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .5 KVA PF: .45 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 64 MCC 4&5 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .5 KVA PF: .45 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 64 MCC 4&5 DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD TO: 62 SS-1 SEC FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .5 KVA PF: .45 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 68 BLUE SSS FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 90 SWGR O TRANSF AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .6 KW 1.1 KVAR 1.2 KVA PF: .46 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 66 SM1A BLUE DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD TO: 60 SWGR S FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 68 BLUE SSS TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 68 BLUE SSS DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD FROM: 64 MCC 4&5 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 66 SM1A BLUE TRANSF AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .7 KVAR .7 KVA PF: .47 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 70 SWGR N DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD FROM: 40 GEN G4 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 50 GEN G5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 60 SWGR S FEEDER AMPS: 317 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1130.1 KW 724.2 KVAR 1342.3 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD FROM: 90 SWGR O FEEDER AMPS: 317 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1130.1 KW 724.2 KVAR 1342.3 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

==== BUS: 80 UTILITY DESIGN VOLTAGE: 24900 BUS VOLTAGE: 24900 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: .0 DEGREES
*** SWING GENERATOR: 6 2480.4 KW 1361.5 KVAR

LOAD TO: 85 T1 SEC TRANSF AMPS: 66 VOLTAGE DROP: -450. %VD: -1.8
PROJECTED POWER FLOW: 2480.4 KW 1361.5 KVAR 2829.5 KVA PF: .88 LAGGING
LOSSES THRU TRANSF: 16.0 KW 171.5 KVAR 172.3 KVA **XFMR TAPS -5.0%**

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 85 T1 SEC DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2443 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD FROM: 80 UTILITY TRANSF AMPS: 647 VOLTAGE DROP: -43. %VD: -1.8
PROJECTED POWER FLOW: 2464.4 KW 1190.0 KVAR 2736.6 KVA PF: .90 LAGGING
LOSSES THRU TRANSF: 16.0 KW 171.5 KVAR 172.3 KVA **XFMR TAPS -5.0%**

LOAD TO: 90 SWGR 0 FEEDER AMPS: 647 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 2464.4 KW 1190.0 KVAR 2736.6 KVA PF: .90 LAGGING
LOSSES THRU FEEDER: .6 KW .6 KVAR .8 KVA

==== BUS: 90 SWGR 0 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2443 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES

LOAD TO: 64 MCC 4&5 TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .6 KW 1.1 KVAR 1.2 KVA PF: .46 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 70 SWGR N FEEDER AMPS: 317 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1130.3 KW 724.4 KVAR 1342.5 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD FROM: 85 T1 SEC FEEDER AMPS: 647 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 2463.8 KW 1189.4 KVAR 2735.9 KVA PF: .90 LAGGING
LOSSES THRU FEEDER: .6 KW .6 KVAR .8 KVA

LOAD FROM: 600 O/H BUS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 700 FDR 7 FEEDER AMPS: 122 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 489.1 KW 165.9 KVAR 516.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .3 KVA

LOAD TO: 800 FDR 8 FEEDER AMPS: 102 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 407.6 KW 144.5 KVAR 432.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 900 FDR 9 FEEDER AMPS: 109 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 436.2 KW 153.6 KVAR 462.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 100 FDR 1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 136 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 544.7 KW 189.6 KVAR 576.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 105 F1F12 14 FEEDER AMPS: 136 VOLTAGE DROP: 44. %VD: 1.8
PROJECTED POWER FLOW: 544.7 KW 189.6 KVAR 576.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: 7.5 KW 10.1 KVAR 12.6 KVA

==== BUS: 105 F1F12 14 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2397 %VD: .1
===== PU BUS VOLTAGE: .999 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 9.0 KW 2.5 KVAR

LOAD FROM: 100 FDR 1 FEEDER AMPS: 136 VOLTAGE DROP: 44. %VD: 1.8
PROJECTED POWER FLOW: 537.2 KW 179.6 KVAR 566.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 7.5 KW 10.1 KVAR 12.6 KVA

LOAD TO: 110 F1 L14 FEEDER AMPS: 134 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 528.2 KW 177.1 KVAR 557.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.6 KVA

==== BUS: 110 F1 L14 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2391 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 20.8 KW 6.9 KVAR

LOAD FROM: 105 F1F12 14 FEEDER AMPS: 134 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 527.2 KW 175.8 KVAR 555.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.6 KVA

LOAD TO: 115 F1 L15 FEEDER AMPS: 6 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 24.8 KW 7.9 KVAR 26.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 120 F1 L31 FEEDER AMPS: 123 VOLTAGE DROP: 10. %VD: .4
PROJECTED POWER FLOW: 481.6 KW 160.9 KVAR 507.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW 2.2 KVAR 2.7 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 115 F1 L15 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2391 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 24.8 KW 7.9 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 6 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 24.8 KW 7.9 KVAR 26.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 120 F1 L31 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2381 %VD: .8
===== PU BUS VOLTAGE: .992 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 218.5 KW 71.8 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 123 VOLTAGE DROP: 10. %VD: .4
PROJECTED POWER FLOW: 480.0 KW 158.7 KVAR 505.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW 2.2 KVAR 2.7 KVA

LOAD TO: 121 F1 L63 FEEDER AMPS: 67 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 261.5 KW 86.9 KVAR 275.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

==== BUS: 121 F1 L63 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2374 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 60.7 KW 20.6 KVAR

LOAD FROM: 120 F1 L31 FEEDER AMPS: 67 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 261.0 KW 86.2 KVAR 274.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

LOAD TO: 122 F1 L64 FEEDER AMPS: 24 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 95.6 KW 31.3 KVAR 100.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 125 F1 L67 FEEDER AMPS: 27 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 104.6 KW 34.3 KVAR 110.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 122 F1 L64 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2373 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 95.6 KW 31.3 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 24 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 95.6 KW 31.3 KVAR 100.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 125 F1 L67 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2373 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 60.6 KW 19.6 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 27 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 104.6 KW 34.2 KVAR 110.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 130 F1 L613 FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 30.3 KW 9.8 KVAR 31.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 135 F1 L68 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 13.7 KW 4.9 KVAR 14.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 130 F1 L613 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2372 %VD: 1.2
===== PU BUS VOLTAGE: .988 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 30.3 KW 9.8 KVAR

LOAD FROM: 125 F1 L67 FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 30.3 KW 9.8 KVAR 31.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 135 F1 L68 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2373 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 13.7 KW 4.9 KVAR

LOAD FROM: 125 F1 L67 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 13.7 KW 4.9 KVAR 14.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 200 FDR 2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 133 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 535.2 KW 178.6 KVAR 564.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 205 FEEDER AMPS: 133 VOLTAGE DROP: 17. %VD: .7
PROJECTED POWER FLOW: 535.2 KW 178.6 KVAR 564.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.9 KW 3.8 KVAR 4.8 KVA

==== BUS: 205 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2424 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 70.4 KW 22.4 KVAR

LOAD FROM: 200 FDR 2 FEEDER AMPS: 133 VOLTAGE DROP: 17. %VD: .7
PROJECTED POWER FLOW: 532.3 KW 174.7 KVAR 560.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.9 KW 3.8 KVAR 4.8 KVA

LOAD TO: 210 2-3 PRI FEEDER AMPS: 60 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 238.4 KW 78.6 KVAR 251.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 235 F5 F29 FEEDER AMPS: 56 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 223.6 KW 73.7 KVAR 235.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

==== BUS: 210 2-3 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2422 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 89.6 KW 29.5 KVAR

LOAD FROM: 205 FEEDER AMPS: 60 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 238.2 KW 78.4 KVAR 250.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 215 2-4 PRI FEEDER AMPS: 37 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 148.6 KW 48.9 KVAR 156.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD FROM: 225 2-3 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 215 2-4 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2422 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 89.6 KW 29.5 KVAR

LOAD FROM: 210 2-3 PRI FEEDER AMPS: 37 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 148.6 KW 48.9 KVAR 156.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 220 2-5 PRI FEEDER AMPS: 15 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 59.0 KW 19.3 KVAR 62.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 230 2-4 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 220 2-5 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2421 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 59.0 KW 19.3 KVAR

LOAD FROM: 215 2-4 PRI FEEDER AMPS: 15 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 59.0 KW 19.3 KVAR 62.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 225 2-3 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 484 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 230 2-4 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 210 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
**** NO LOAD SPECIFIED ****

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 235 F5 F29 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2419 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 44.7 KW 14.2 KVAR

LOAD FROM: 205 FEEDER AMPS: 56 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 223.2 KW 73.2 KVAR 234.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

LOAD TO: 236 F2 F211 FEEDER AMPS: 45 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 178.5 KW 59.0 KVAR 188.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 236 F2 F211 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2417 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 89.2 KW 29.4 KVAR

LOAD FROM: 235 F5 F29 FEEDER AMPS: 45 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 178.4 KW 58.8 KVAR 187.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 240 F1 F213 FEEDER AMPS: 22 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 89.2 KW 29.4 KVAR 93.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 240 F1 F213 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2415 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 89.1 KW 29.4 KVAR

LOAD FROM: 236 F2 F211 FEEDER AMPS: 22 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 89.1 KW 29.4 KVAR 93.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 300 FDR 3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 93 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 372.7 KW 125.0 KVAR 393.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 301 F8 F311 FEEDER AMPS: 93 VOLTAGE DROP: 8. %VD: .3
PROJECTED POWER FLOW: 372.7 KW 125.0 KVAR 393.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW 1.2 KVAR 1.6 KVA

==== BUS: 301 F8 F311 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2433 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 191.2 KW 62.7 KVAR

LOAD FROM: 300 FDR 3 FEEDER AMPS: 93 VOLTAGE DROP: 8. %VD: .3
PROJECTED POWER FLOW: 371.7 KW 123.8 KVAR 391.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW 1.2 KVAR 1.6 KVA

LOAD TO: 303 F713 FEEDER AMPS: 45 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 180.5 KW 61.1 KVAR 190.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

==== BUS: 303 F713 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2431 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES

LOAD FROM: 301 F8 F311 FEEDER AMPS: 45 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 180.4 KW 60.9 KVAR 190.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD TO: 305 F8 F311 FEEDER AMPS: 45 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 180.4 KW 60.9 KVAR 190.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

==== BUS: 305 F8 F311 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2428 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.3 KW 5.1 KVAR

LOAD FROM: 303 F713 FEEDER AMPS: 45 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 180.2 KW 60.6 KVAR 190.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

LOAD TO: 310 F3 19 FEEDER AMPS: 41 VOLTAGE DROP: 11. %VD: .4
PROJECTED POWER FLOW: 164.8 KW 55.5 KVAR 173.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .7 KVAR .9 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 310 F3 19 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2417 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 164.3 KW 54.8 KVAR

LOAD FROM: 305 F8 F311 FEEDER AMPS: 41 VOLTAGE DROP: 11. %VD: .4
PROJECTED POWER FLOW: 164.3 KW 54.8 KVAR 173.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .7 KVAR .9 KVA

==== BUS: 400 FDR 4 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 104 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 415.7 KW 139.5 KVAR 438.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 401 4-1 PRI FEEDER AMPS: 104 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 415.7 KW 139.5 KVAR 438.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

==== BUS: 401 4-1 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2436 %VD: -1.5
===== PU BUS VOLTAGE: 1.015 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 77.2 KW 25.7 KVAR

LOAD FROM: 400 FDR 4 FEEDER AMPS: 104 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 415.0 KW 138.5 KVAR 437.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

LOAD TO: 403 F1 F45 FEEDER AMPS: 84 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 337.7 KW 112.8 KVAR 356.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .6 KVAR .8 KVA

==== BUS: 403 F1 F45 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2431 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 125.0 KW 41.0 KVAR

LOAD FROM: 401 4-1 PRI FEEDER AMPS: 84 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 337.2 KW 112.2 KVAR 355.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .6 KVAR .8 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 405 F4 10 FEEDER AMPS: 53 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 212.2 KW 71.2 KVAR 223.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

==== BUS: 405 F4 10 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2425 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 66.4 KW 22.5 KVAR

LOAD FROM: 403 F1 F45 FEEDER AMPS: 53 VOLTAGE DROP: 6. %VD: .2
PROJECTED POWER FLOW: 211.9 KW 70.6 KVAR 223.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

LOAD TO: 410 F417 UF1 FEEDER AMPS: 36 VOLTAGE DROP: 8. %VD: .3
PROJECTED POWER FLOW: 145.5 KW 48.2 KVAR 153.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

==== BUS: 410 F417 UF1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2418 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 145.1 KW 47.7 KVAR

LOAD FROM: 405 F4 10 FEEDER AMPS: 36 VOLTAGE DROP: 8. %VD: .3
PROJECTED POWER FLOW: 145.1 KW 47.7 KVAR 152.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

LOAD TO: 415 4-6 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 415 4-6 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 210 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 500 FDR 5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 65 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 261.1 KW 91.7 KVAR 276.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 505 F4 F5 F6UF FEEDER AMPS: 65 VOLTAGE DROP: 9. %VD: .4
PROJECTED POWER FLOW: 261.1 KW 91.7 KVAR 276.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

==== BUS: 505 F4 F5 F6UF DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2433 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.1 DEGREES

LOAD FROM: 500 FDR 5 FEEDER AMPS: 65 VOLTAGE DROP: 9. %VD: .4
PROJECTED POWER FLOW: 260.4 KW 90.7 KVAR 275.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

LOAD TO: 510 5-1 PRI FEEDER AMPS: 8 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.3 KVAR 33.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 512 5-3 PRI FEEDER AMPS: 58 VOLTAGE DROP: 20. %VD: .8
PROJECTED POWER FLOW: 228.6 KW 80.5 KVAR 242.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: 1.4 KW 1.9 KVAR 2.4 KVA

==== BUS: 510 5-1 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2432 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 31.8 KW 10.3 KVAR

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 8 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.3 KVAR 33.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 512 5-3 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2413 %VD: -.5
===== PU BUS VOLTAGE: 1.005 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 14.2 KW 5.1 KVAR

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 58 VOLTAGE DROP: 20. %VD: .8
PROJECTED POWER FLOW: 227.1 KW 78.5 KVAR 240.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW 1.9 KVAR 2.4 KVA

LOAD TO: 514 5-5 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.0 KVAR 5.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 515 F5 L24 FEEDER AMPS: 53 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 207.9 KW 71.5 KVAR 219.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW 1.2 KVAR 1.5 KVA

==== BUS: 514 5-5 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2413 %VD: -.5
===== PU BUS VOLTAGE: 1.005 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 2.0 KVAR

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.0 KVAR 5.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 515 F5 L24 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2399 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.0 KW 3.3 KVAR

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 53 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 207.0 KW 70.3 KVAR 218.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW 1.2 KVAR 1.5 KVA

LOAD TO: 520 5-6 PRI FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.0 KW 2.0 KVAR 5.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 525 F5 L31 FEEDER AMPS: 49 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 194.0 KW 65.0 KVAR 204.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 520 5-6 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2398 %VD: .1
===== PU BUS VOLTAGE: .999 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.0 KW 2.0 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.0 KW 2.0 KVAR 5.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 525 F5 L31 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2397 %VD: .1
===== PU BUS VOLTAGE: .999 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.0 KW 3.3 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 49 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 193.9 KW 64.9 KVAR 204.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 530 F5 L39 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.0 KW 1.9 KVAR 5.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 531 F3 L41 FEEDER AMPS: 24 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 95.6 KW 31.5 KVAR 100.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 22 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 85.3 KW 28.2 KVAR 89.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 530 F5 L39 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2397 %VD: .1
===== PU BUS VOLTAGE: .999 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.0 KW 1.9 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.0 KW 1.9 KVAR 5.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 531 F3 L41 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2395 %VD: .2
===== PU BUS VOLTAGE: .998 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.9 KW 5.0 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 24 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 95.5 KW 31.3 KVAR 100.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 20 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 79.6 KW 26.4 KVAR 83.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 535 F537 L5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2391 XVD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.0 KW 1.9 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 22 VOLTAGE DROP: 6. XVD: .3
PROJECTED POWER FLOW: 85.2 KW 28.0 KVAR 89.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD FROM: 531 F3 L41 FEEDER AMPS: 20 VOLTAGE DROP: 4. XVD: .2
PROJECTED POWER FLOW: 79.5 KW 26.2 KVAR 83.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD TO: 540 F5 L5 UF1 FEEDER AMPS: 4 VOLTAGE DROP: 0. XVD: .0
PROJECTED POWER FLOW: 15.9 KW 6.0 KVAR 16.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 555 FEEDER AMPS: 36 VOLTAGE DROP: 9. XVD: .4
PROJECTED POWER FLOW: 143.8 KW 46.4 KVAR 151.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .4 KVAR .6 KVA

==== BUS: 540 F5 L5 UF1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2391 XVD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW 1.0 KVAR

LOAD FROM: 535 F537 L5 FEEDER AMPS: 4 VOLTAGE DROP: 0. XVD: .0
PROJECTED POWER FLOW: 15.9 KW 5.9 KVAR 16.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 545 F5 L56 UF1 FEEDER AMPS: 3 VOLTAGE DROP: 3. XVD: .1
PROJECTED POWER FLOW: 11.9 KW 4.0 KVAR 12.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 550 F5 L55 FEEDER AMPS: 1 VOLTAGE DROP: 0. XVD: .0
PROJECTED POWER FLOW: 2.0 KW 1.0 KVAR 2.2 KVA PF: .89 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 545 F5 L56 UF1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2387 %VD: .5
===== PU BUS VOLTAGE: .995 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 11.9 KW 4.0 KVAR

LOAD FROM: 540 F5 L5 UF1 FEEDER AMPS: 3 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 11.9 KW 4.0 KVAR 12.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 547 5-16 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 547 5-16 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 207 %VD: .5
===== PU BUS VOLTAGE: .995 ANGLE: -3.8 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 550 F5 L55 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2391 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW 1.0 KVAR

LOAD FROM: 540 F5 L5 UF1 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 2.0 KW 1.0 KVAR 2.2 KVA PF: .89 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 555 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2382 %VD: .7
===== PU BUS VOLTAGE: .993 ANGLE: -3.9 DEGREES

LOAD FROM: 535 F537 L5 FEEDER AMPS: 36 VOLTAGE DROP: 9. %VD: .4
PROJECTED POWER FLOW: 143.4 KW 46.0 KVAR 150.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .4 KVAR .6 KVA

LOAD TO: 560 RICH SUB FEEDER AMPS: 6 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 25.2 KW 8.4 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 565 5-17 PRI FEEDER AMPS: 30 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 118.2 KW 37.7 KVAR 124.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .3 KVAR .4 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 560 RICH SUB DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2376 %VD: 1.0
===== PU BUS VOLTAGE: .990 ANGLE: -4.0 DEGREES

LOAD FROM: 555 FEEDER AMPS: 6 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 25.1 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 562 RS SEC TRANSF AMPS: 6 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 25.1 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

==== BUS: 562 RS SEC DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7119 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES

LOAD FROM: 560 RICH SUB TRANSF AMPS: 2 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

LOAD TO: 930 RICH SUB FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 565 5-17 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2375 %VD: 1.0
===== PU BUS VOLTAGE: .990 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.9 KW 1.9 KVAR

LOAD FROM: 555 FEEDER AMPS: 30 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 117.9 KW 37.4 KVAR 123.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .3 KVAR .4 KVA

LOAD TO: 570 5-18 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 7.8 KW 3.2 KVAR 8.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 575 F5 51 FEEDER AMPS: 27 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 105.2 KW 32.2 KVAR 110.0 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 570 5-18 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2375 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 7.8 KW 3.2 KVAR

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 7.8 KW 3.2 KVAR 8.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 575 F5 51 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2373 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW .6 KVAR

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 27 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 105.1 KW 32.2 KVAR 109.9 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 580 F5 L85 FEEDER AMPS: 26 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 103.1 KW 31.5 KVAR 107.8 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .2 KVA

==== BUS: 580 F5 L85 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2368 %VD: 1.3
===== PU BUS VOLTAGE: .987 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 7.8 KW 3.2 KVAR

LOAD FROM: 575 F5 51 FEEDER AMPS: 26 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 103.0 KW 31.4 KVAR 107.6 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .2 KVA

LOAD TO: 585 F5 L87 UF1 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 23.4 KW 7.8 KVAR 24.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 590 F5 L8911 FEEDER AMPS: 18 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 71.8 KW 20.4 KVAR 74.7 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 585 F5 L87 UF1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2367 %VD: 1.4
===== PU BUS VOLTAGE: .986 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 23.3 KW 7.8 KVAR

LOAD FROM: 580 F5 L85 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 23.3 KW 7.8 KVAR 24.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 590 F5 L8911 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2364 %VD: 1.5
===== PU BUS VOLTAGE: .985 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 39.8 KW 10.7 KVAR

LOAD FROM: 580 F5 L85 FEEDER AMPS: 18 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 71.7 KW 20.3 KVAR 74.5 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 591 5-23 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 593 5-24 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 595 F5 L8 25 FEEDER AMPS: 8 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 31.9 KW 9.7 KVAR 33.4 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 591 5-23 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 205 %VD: 1.5
===== PU BUS VOLTAGE: .985 ANGLE: -4.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 593 5-24 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 205 %VD: 1.5
===== PU BUS VOLTAGE: .985 ANGLE: -4.1 DEGREES
**** NO LOAD SPECIFIED ****

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 595 F5 L8 25 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2357 %VD: 1.8
===== PU BUS VOLTAGE: .982 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 31.8 KW 9.6 KVAR

LOAD FROM: 590 F5 L8911 FEEDER AMPS: 8 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 31.8 KW 9.6 KVAR 33.3 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 600 O/H BUS DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2443 %VD: -1.8
===== PU BUS VOLTAGE: 1.018 ANGLE: -3.0 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 700 FDR 7 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 122 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 488.8 KW 165.8 KVAR 516.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .3 KVA

LOAD TO: 705 WELL9 POL FEEDER AMPS: 122 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 488.8 KW 165.8 KVAR 516.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .3 KVA

==== BUS: 705 WELL9 POL DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2440 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 42.4 KW 14.5 KVAR

LOAD FROM: 700 FDR 7 FEEDER AMPS: 122 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 488.6 KW 165.5 KVAR 515.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .3 KVA

LOAD FROM: 707 7-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 709 F9 F73 FEEDER AMPS: 111 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 446.3 KW 151.1 KVAR 471.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .9 KVAR 1.1 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 707 7-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 709 F9 F73 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2435 %VD: -1.5
===== PU BUS VOLTAGE: 1.015 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 85.5 KW 27.8 KVAR

LOAD FROM: 705 WELL9 POL FEEDER AMPS: 111 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 445.6 KW 150.2 KVAR 470.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .9 KVAR 1.1 KVA

LOAD TO: 710 F7 L11 FEEDER AMPS: 90 VOLTAGE DROP: 19. %VD: .8
PROJECTED POWER FLOW: 360.1 KW 122.4 KVAR 380.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.2 KW 2.9 KVAR 3.7 KVA

==== BUS: 710 F7 L11 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2416 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 85.1 KW 28.4 KVAR

LOAD FROM: 709 F9 F73 FEEDER AMPS: 90 VOLTAGE DROP: 19. %VD: .8
PROJECTED POWER FLOW: 357.9 KW 119.4 KVAR 377.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.2 KW 2.9 KVAR 3.7 KVA

LOAD TO: 715 F7 L13 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.3 KW 7.1 KVAR 22.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 720 F713 FEEDER AMPS: 63 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 251.5 KW 84.0 KVAR 265.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

==== BUS: 715 F7 L13 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2416 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 21.3 KW 7.1 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.3 KW 7.1 KVAR 22.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 720 F713 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2409 %VD: -.4
===== PU BUS VOLTAGE: 1.004 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 31.2 KW 10.1 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 63 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 251.0 KW 83.2 KVAR 264.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

LOAD TO: 725 7-15 PRI FEEDER AMPS: 55 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 219.7 KW 73.2 KVAR 231.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.7 KVA

==== BUS: 725 7-15 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2395 %VD: .2
===== PU BUS VOLTAGE: .998 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 91.6 KW 29.9 KVAR

LOAD FROM: 720 F713 FEEDER AMPS: 55 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 218.7 KW 71.8 KVAR 230.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.7 KVA

LOAD TO: 730 F7 L43 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 11.9 KW 4.0 KVAR 12.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 735 F7 L54 FEEDER AMPS: 29 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 115.2 KW 38.0 KVAR 121.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 730 F7 L43 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2395 %VD: .2
===== PU BUS VOLTAGE: .998 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 11.9 KW 4.0 KVAR

LOAD FROM: 725 7-15 PRI FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 11.9 KW 4.0 KVAR 12.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 735 F7 L54 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2393 %VD: .3
===== PU BUS VOLTAGE: .997 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 20.9 KW 7.0 KVAR

LOAD FROM: 725 7-15 PRI FEEDER AMPS: 29 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 115.1 KW 37.9 KVAR 121.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 740 7-17 PRI FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 16.9 KW 5.0 KVAR 17.6 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 745 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 77.3 KW 25.9 KVAR 81.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 740 7-17 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2392 %VD: .3
===== PU BUS VOLTAGE: .997 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 16.9 KW 5.0 KVAR

LOAD FROM: 735 F7 L54 FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 16.9 KW 5.0 KVAR 17.6 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 745 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2390 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.8 DEGREES

LOAD FROM: 735 F7 L54 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 77.2 KW 25.8 KVAR 81.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 750 F7 L72 FEEDER AMPS: 7 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 8.9 KVAR 29.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 760 7-21 PRI FEEDER AMPS: 13 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 49.5 KW 16.9 KVAR 52.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 770 7-23 PRI FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 16.8 KW 5.9 KVAR 17.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 770 7-23 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2385 %VD: .6
===== PU BUS VOLTAGE: .994 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.9 KW 2.0 KVAR

LOAD FROM: 765 7-22 PRI FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 16.8 KW 5.9 KVAR 17.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 775 7-24 PRI FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 11.8 KW 3.9 KVAR 12.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 775 7-24 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2384 %VD: .7
===== PU BUS VOLTAGE: .993 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 11.8 KW 3.9 KVAR

LOAD FROM: 770 7-23 PRI FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 11.8 KW 3.9 KVAR 12.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 800 FDR 8 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2442 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.0 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 102 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 407.5 KW 144.4 KVAR 432.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 805 F8 L11 FEEDER AMPS: 102 VOLTAGE DROP: 40. %VD: 1.7
PROJECTED POWER FLOW: 407.5 KW 144.4 KVAR 432.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: 5.1 KW 6.8 KVAR 8.5 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 805 F8 L11 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2402 %VD: -.1
===== PU BUS VOLTAGE: 1.001 ANGLE: -3.6 DEGREES
PROJECTED SPECIAL BUS LOAD: 30.1 KW 10.0 KVAR

LOAD FROM: 800 FDR 8 FEEDER AMPS: 102 VOLTAGE DROP: 40. %VD: 1.7
PROJECTED POWER FLOW: 402.4 KW 137.6 KVAR 425.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 5.1 KW 6.8 KVAR 8.5 KVA

LOAD TO: 810 F8 L23 FEEDER AMPS: 95 VOLTAGE DROP: 20. %VD: .8
PROJECTED POWER FLOW: 372.3 KW 127.6 KVAR 393.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.4 KW 3.2 KVAR 4.0 KVA

==== BUS: 810 F8 L23 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2382 %VD: .8
===== PU BUS VOLTAGE: .992 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 71.9 KW 23.6 KVAR

LOAD FROM: 805 F8 L11 FEEDER AMPS: 95 VOLTAGE DROP: 20. %VD: .8
PROJECTED POWER FLOW: 369.9 KW 124.4 KVAR 390.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.4 KW 3.2 KVAR 4.0 KVA

LOAD TO: 815 F8 L25 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 4.2 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 817 F8 22 FEEDER AMPS: 75 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 293.8 KW 99.4 KVAR 310.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

==== BUS: 815 F8 L25 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2382 %VD: .8
===== PU BUS VOLTAGE: .992 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.2 KW 1.4 KVAR

LOAD FROM: 810 F8 L23 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 4.2 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 905 STEP SEC TRANSF AMPS: 109 VOLTAGE DROP: 16. %VD: .7
PROJECTED POWER FLOW: 436.1 KW 153.5 KVAR 462.3 KVA PF: .94 LAGGING
LOSSES THRU TRANSF: 1.1 KW 6.2 KVAR 6.3 KVA

==== BUS: 905 STEP SEC DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7277 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.7 DEGREES

LOAD FROM: 900 FDR 9 TRANSF AMPS: 36 VOLTAGE DROP: 48. %VD: .7
PROJECTED POWER FLOW: 435.0 KW 147.3 KVAR 459.2 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: 1.1 KW 6.2 KVAR 6.3 KVA

LOAD TO: 910 F 96 FEEDER AMPS: 36 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 435.0 KW 147.3 KVAR 459.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

==== BUS: 910 F 96 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7272 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 18.2 KW 6.0 KVAR

LOAD FROM: 905 STEP SEC FEEDER AMPS: 36 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 434.8 KW 147.0 KVAR 458.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

LOAD TO: 915 F910 FEEDER AMPS: 35 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 416.6 KW 141.0 KVAR 439.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .4 KVA

==== BUS: 915 F910 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7266 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 60.7 KW 20.0 KVAR

LOAD FROM: 910 F 96 FEEDER AMPS: 35 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 416.3 KW 140.7 KVAR 439.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .4 KVA

LOAD TO: 920 F940 FEEDER AMPS: 30 VOLTAGE DROP: 29. %VD: .4
PROJECTED POWER FLOW: 355.6 KW 120.7 KVAR 375.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.1 KW 1.4 KVAR 1.8 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 920 F940 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7237 %VD: -.5
===== PU BUS VOLTAGE: 1.005 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 10.4 KW 3.4 KVAR

LOAD FROM: 915 F910 FEEDER AMPS: 30 VOLTAGE DROP: 29. %VD: .4
PROJECTED POWER FLOW: 354.5 KW 119.3 KVAR 374.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.1 KW 1.4 KVAR 1.8 KVA

LOAD TO: 945 F949 L1 FEEDER AMPS: 29 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 344.2 KW 115.9 KVAR 363.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 925 () DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7117 %VD: 1.2
===== PU BUS VOLTAGE: .988 ANGLE: -4.1 DEGREES

LOAD FROM: 930 RICH SUB FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 935 9-8 PRI FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 930 RICH SUB DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7119 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.1 DEGREES

LOAD FROM: 562 RS SEC FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 925 () FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 935 9-8 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7114 %VD: 1.2
===== PU BUS VOLTAGE: .988 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 10.0 KW 3.3 KVAR

LOAD FROM: 925 () FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.2 KVAR 26.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 940 9-9 PRI FEEDER AMPS: 1 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 15.0 KW 4.9 KVAR 15.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 940 9-9 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7106 %VD: 1.3
===== PU BUS VOLTAGE: .987 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.0 KW 4.9 KVAR

LOAD FROM: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 15.0 KW 4.9 KVAR 15.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 945 F949 L1 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7232 %VD: -.4
===== PU BUS VOLTAGE: 1.004 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.4 KW 1.8 KVAR

LOAD FROM: 920 F940 FEEDER AMPS: 29 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 344.0 KW 115.6 KVAR 362.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 950 9-12 PRI FEEDER AMPS: 1 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 8.3 KW 2.7 KVAR 8.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 960 9-13 PRI FEEDER AMPS: 28 VOLTAGE DROP: 32. %VD: .4
PROJECTED POWER FLOW: 330.3 KW 111.1 KVAR 348.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.6 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 950 9-12 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7230 %VD: -.4
===== PU BUS VOLTAGE: 1.004 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.1 KW 1.4 KVAR

LOAD FROM: 945 F949 L1 FEEDER AMPS: 1 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 8.3 KW 2.7 KVAR 8.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 955 9-11 PRI FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 4.1 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 955 9-11 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7230 %VD: -.4
===== PU BUS VOLTAGE: 1.004 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.1 KW 1.4 KVAR

LOAD FROM: 950 9-12 PRI FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 4.1 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 960 9-13 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7200 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 17.8 KW 5.8 KVAR

LOAD FROM: 945 F949 L1 FEEDER AMPS: 28 VOLTAGE DROP: 32. %VD: .4
PROJECTED POWER FLOW: 328.9 KW 110.5 KVAR 346.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.6 KVA

LOAD TO: 963 9-14 PRI FEEDER AMPS: 26 VOLTAGE DROP: 105. %VD: 1.5
PROJECTED POWER FLOW: 311.1 KW 104.6 KVAR 328.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 4.4 KW 2.1 KVAR 4.8 KVA

==== BUS: 963 9-14 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7095 %VD: 1.5
===== PU BUS VOLTAGE: .985 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 17.3 KW 5.7 KVAR

LOAD FROM: 960 9-13 PRI FEEDER AMPS: 26 VOLTAGE DROP: 105. %VD: 1.5
PROJECTED POWER FLOW: 306.7 KW 102.5 KVAR 323.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 4.4 KW 2.1 KVAR 4.8 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 966 9-15 PRI FEEDER AMPS: 25 VOLTAGE DROP: 29. %VD: .4
PROJECTED POWER FLOW: 289.4 KW 96.8 KVAR 305.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.1 KW .5 KVAR 1.2 KVA

==== BUS: 966 9-15 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7066 %VD: 1.9
===== PU BUS VOLTAGE: .981 ANGLE: -4.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW .7 KVAR

LOAD FROM: 963 9-14 PRI FEEDER AMPS: 25 VOLTAGE DROP: 29. %VD: .4
PROJECTED POWER FLOW: 288.3 KW 96.3 KVAR 304.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.1 KW .5 KVAR 1.2 KVA

LOAD TO: 969 SW UP FEEDER AMPS: 25 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 286.3 KW 95.6 KVAR 301.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

==== BUS: 969 SW UP DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7058 %VD: 2.0
===== PU BUS VOLTAGE: .980 ANGLE: -4.1 DEGREES

LOAD FROM: 966 9-15 PRI FEEDER AMPS: 25 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 286.0 KW 95.5 KVAR 301.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 972 SW DOWN FEEDER AMPS: 25 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 286.0 KW 95.5 KVAR 301.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 972 SW DOWN DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7058 %VD: 2.0
===== PU BUS VOLTAGE: .980 ANGLE: -4.1 DEGREES

LOAD FROM: 969 SW UP FEEDER AMPS: 25 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 286.0 KW 95.5 KVAR 301.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 975 9-16 PRI FEEDER AMPS: 25 VOLTAGE DROP: 109. %VD: 1.5
PROJECTED POWER FLOW: 286.0 KW 95.5 KVAR 301.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 4.2 KW 2.0 KVAR 4.7 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 975 9-16 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6949 %VD: 3.5
===== PU BUS VOLTAGE: .965 ANGLE: -4.2 DEGREES

LOAD FROM: 972 SW DOWN FEEDER AMPS: 25 VOLTAGE DROP: 109. %VD: 1.5
PROJECTED POWER FLOW: 281.8 KW 93.5 KVAR 296.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 4.2 KW 2.0 KVAR 4.7 KVA

LOAD TO: 977 9-19 PRI FEEDER AMPS: 1 VOLTAGE DROP: 7. %VD: .1
PROJECTED POWER FLOW: 15.3 KW 5.0 KVAR 16.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 980 FEEDER AMPS: 23 VOLTAGE DROP: 43. %VD: .6
PROJECTED POWER FLOW: 266.5 KW 88.4 KVAR 280.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW .8 KVAR 1.7 KVA

==== BUS: 977 9-19 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6942 %VD: 3.6
===== PU BUS VOLTAGE: .964 ANGLE: -4.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.3 KW 5.0 KVAR

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 1 VOLTAGE DROP: 7. %VD: .1
PROJECTED POWER FLOW: 15.3 KW 5.0 KVAR 16.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 980 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6906 %VD: 4.1
===== PU BUS VOLTAGE: .959 ANGLE: -4.3 DEGREES

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 23 VOLTAGE DROP: 43. %VD: .6
PROJECTED POWER FLOW: 264.9 KW 87.7 KVAR 279.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW .8 KVAR 1.7 KVA

LOAD TO: 982 9-20 PRI FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.7 KW 1.9 KVAR 6.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 983 9-25 PRI FEEDER AMPS: 23 VOLTAGE DROP: 72. %VD: 1.0
PROJECTED POWER FLOW: 259.2 KW 85.8 KVAR 273.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.6 KW 1.2 KVAR 2.9 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 982 9-20 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6906 %VD: 4.1
===== PU BUS VOLTAGE: .959 ANGLE: -4.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.7 KW 1.9 KVAR

LOAD FROM: 980 FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.7 KW 1.9 KVAR 6.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 983 9-25 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6834 %VD: 5.1\$
===== PU BUS VOLTAGE: .949 ANGLE: -4.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 146.5 KW 48.2 KVAR

LOAD FROM: 980 FEEDER AMPS: 23 VOLTAGE DROP: 72. %VD: 1.0
PROJECTED POWER FLOW: 256.6 KW 84.6 KVAR 270.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.6 KW 1.2 KVAR 2.9 KVA

LOAD TO: 984 9-25 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 985 9-34 PRI FEEDER AMPS: 10 VOLTAGE DROP: 10. %VD: .1
PROJECTED POWER FLOW: 110.1 KW 36.4 KVAR 116.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

==== BUS: 984 9-25 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 197 %VD: 5.1\$
===== PU BUS VOLTAGE: .949 ANGLE: -4.3 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 985 9-34 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6824 %VD: 5.2\$
===== PU BUS VOLTAGE: .948 ANGLE: -4.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 9.6 KW 3.2 KVAR

LOAD FROM: 983 9-25 PRI FEEDER AMPS: 10 VOLTAGE DROP: 10. %VD: .1
PROJECTED POWER FLOW: 110.0 KW 36.3 KVAR 115.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 987 FEEDER AMPS: 9 VOLTAGE DROP: 30. %VD: .4
PROJECTED POWER FLOW: 100.4 KW 33.2 KVAR 105.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .2 KVAR .5 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 987 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6794 %VD: 5.65
===== PU BUS VOLTAGE: .944 ANGLE: -4.4 DEGREES

LOAD FROM: 985 9-34 PRI FEEDER AMPS: 9 VOLTAGE DROP: 30. %VD: .4
PROJECTED POWER FLOW: 99.9 KW 33.0 KVAR 105.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .2 KVAR .5 KVA

LOAD TO: 990 9-26 PRI FEEDER AMPS: 4 VOLTAGE DROP: 19. %VD: .3
PROJECTED POWER FLOW: 41.0 KW 13.5 KVAR 43.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 992 FEEDER AMPS: 5 VOLTAGE DROP: 75. %VD: 1.0
PROJECTED POWER FLOW: 58.9 KW 19.5 KVAR 62.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .3 KVAR .7 KVA

==== BUS: 990 9-26 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6775 %VD: 5.95
===== PU BUS VOLTAGE: .941 ANGLE: -4.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 40.9 KW 13.4 KVAR

LOAD FROM: 987 FEEDER AMPS: 4 VOLTAGE DROP: 19. %VD: .3
PROJECTED POWER FLOW: 40.9 KW 13.4 KVAR 43.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 992 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6719 %VD: 6.75
===== PU BUS VOLTAGE: .933 ANGLE: -4.5 DEGREES

LOAD FROM: 987 FEEDER AMPS: 5 VOLTAGE DROP: 75. %VD: 1.0
PROJECTED POWER FLOW: 58.3 KW 19.2 KVAR 61.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .3 KVAR .7 KVA

LOAD TO: 995 9-30 PRI FEEDER AMPS: 4 VOLTAGE DROP: 52. %VD: .7
PROJECTED POWER FLOW: 40.0 KW 13.1 KVAR 42.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .0 KVAR .3 KVA

LOAD TO: 997 9-32 PRI FEEDER AMPS: 2 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 18.3 KW 6.1 KVAR 19.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 995 9-30 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6667 %VD: 7.4\$
===== PU BUS VOLTAGE: .926 ANGLE: -4.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 39.7 KW 13.0 KVAR

LOAD FROM: 992 FEEDER AMPS: 4 VOLTAGE DROP: 52. %VD: .7
PROJECTED POWER FLOW: 39.7 KW 13.0 KVAR 41.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .0 KVAR .3 KVA

==== BUS: 997 9-32 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 6715 %VD: 6.7\$
===== PU BUS VOLTAGE: .933 ANGLE: -4.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 18.3 KW 6.1 KVAR

LOAD FROM: 992 FEEDER AMPS: 2 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 18.3 KW 6.1 KVAR 19.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.018	20	GEN G2	2400.00	1.018
30	GEN G3	2400.00	1.018	40	GEN G4	2400.00	1.018
50	GEN G5	2400.00	1.018	60	SWGR S	2400.00	1.018
62	SS-1 SEC	480.00	1.018	64	MCC 4&5	480.00	1.018
66	SM1A BLUE	2400.00	1.018	68	BLUE SSS	480.00	1.018
70	SWGR N	2400.00	1.018	80	UTILITY	24900.00	1.000
85	T1 SEC	2400.00	1.018	90	SWGR O	2400.00	1.018
100	FDR 1	2400.00	1.017	105	F1F12 14	2400.00	.999
110	F1 L14	2400.00	.996	115	F1 L15	2400.00	.996
120	F1 L31	2400.00	.992	121	F1 L63	2400.00	.989
122	F1 L64	2400.00	.989	125	F1 L67	2400.00	.989
130	F1 L613	2400.00	.988	135	F1 L68	2400.00	.989
200	FDR 2	2400.00	1.017	205		2400.00	1.010
210	2-3 PRI	2400.00	1.009	215	2-4 PRI	2400.00	1.009
220	2-5 PRI	2400.00	1.009	225	2-3 SEC	480.00	1.009
230	2-4 SEC	208.00	1.009	235	F5 F29	2400.00	1.008
236	F2 F211	2400.00	1.007	240	F1 F213	2400.00	1.006
300	FDR 3	2400.00	1.017	301	F8 F311	2400.00	1.014
303	F713	2400.00	1.013	305	F8 F311	2400.00	1.011
310	F3 19	2400.00	1.007	400	FDR 4	2400.00	1.017
401	4-1 PRI	2400.00	1.015	403	F1 F45	2400.00	1.013
405	F4 10	2400.00	1.011	410	F417 UF1	2400.00	1.007
415	4-6 SEC	208.00	1.007	500	FDR 5	2400.00	1.017
505	F4 F5 F6UF	2400.00	1.014	510	5-1 PRI	2400.00	1.013
512	5-3 PRI	2400.00	1.005	514	5-5 PRI	2400.00	1.005
515	F5 L24	2400.00	1.000	520	5-6 PRI	2400.00	.999
525	F5 L31	2400.00	.999	530	F5 L39	2400.00	.999
531	F3 L41	2400.00	.998	535	F537 L5	2400.00	.996
540	F5 L5 UF1	2400.00	.996	545	F5 L56 UF1	2400.00	.995
547	5-16 SEC	208.00	.995	550	F5 L55	2400.00	.996
555		2400.00	.993	560	RICH SUB	2400.00	.990
562	RS SEC	7200.00	.989	565	5-17 PRI	2400.00	.990
570	5-18 PRI	2400.00	.989	575	F5 51	2400.00	.989
580	F5 L85	2400.00	.987	585	F5 L87 UF1	2400.00	.986
590	F5 L8911	2400.00	.985	591	5-23 SEC	208.00	.985
593	5-24 SEC	208.00	.985	595	F5 L8 25	2400.00	.982
600	O/H BUS	2400.00	1.018	700	FDR 7	2400.00	1.017
705	WELL9 POL	2400.00	1.017	707	7-1 SEC	480.00	1.017
709	F9 F73	2400.00	1.015	710	F7 L11	2400.00	1.007
715	F7 L13	2400.00	1.006	720	F713	2400.00	1.004

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
725	7-15 PRI	2400.00	.998	730	F7 L43	2400.00	.998
735	F7 L54	2400.00	.997	740	7-17 PRI	2400.00	.997
745		2400.00	.996	750	F7 L72	2400.00	.996
755	F7-33	2400.00	.996	760	7-21 PRI	2400.00	.994
765	7-22 PRI	2400.00	.994	770	7-23 PRI	2400.00	.994
775	7-24 PRI	2400.00	.993	800	FDR 8	2400.00	1.017
805	F8 L11	2400.00	1.001	810	F8 L23	2400.00	.992
815	F8 L25	2400.00	.992	817	F8 22	2400.00	.991
820	F8 30 UF1	2400.00	.985	825	8-22 PRI	2400.00	.979
900	FDR 9	2400.00	1.017	905	STEP SEC	7200.00	1.011
910	F 96	7200.00	1.010	915	F910	7200.00	1.009
920	F940	7200.00	1.005	925	()	7200.00	.988
930	RICH SUB	7200.00	.989	935	9-8 PRI	7200.00	.988
940	9-9 PRI	7200.00	.987	945	F949 L1	7200.00	1.004
950	9-12 PRI	7200.00	1.004	955	9-11 PRI	7200.00	1.004
960	9-13 PRI	7200.00	1.000	963	9-14 PRI	7200.00	.985
966	9-15 PRI	7200.00	.981	969	SW UP	7200.00	.980
972	SW DOWN	7200.00	.980	975	9-16 PRI	7200.00	.965
977	9-19 PRI	7200.00	.964	980		7200.00	.959
982	9-20 PRI	7200.00	.959	983	9-25 PRI	7200.00	.949
984	9-25 SEC	208.00	.949	985	9-34 PRI	7200.00	.948
987		7200.00	.944	990	9-26 PRI	7200.00	.941
992		7200.00	.933	995	9-30 PRI	7200.00	.926
997	9-32 PRI	7200.00	.933				

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	60	SWGR S	FDR	.03	236.34	1000.00	50.83
20	GEN G2	60	SWGR S	FDR	.00	.00	.00	.00
30	GEN G3	60	SWGR S	FDR	.00	.00	.00	.00
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	10	GEN G1	FDR	.03	236.34	999.75	50.83
60	SWGR S	20	GEN G2	FDR	.00	.00	.00	.00
60	SWGR S	30	GEN G3	FDR	.00	.00	.00	.00
60	SWGR S	62	SS-1 SEC	TX2	.01	.11	.48	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.17	.74	.04
60	SWGR S	70	SWGR N	FDR	.01	317.30	1342.21	68.24
60	SWGR S	100	FDR 1	FDR	.06	136.43	577.11	59.32
60	SWGR S	200	FDR 2	FDR	.05	133.46	564.54	58.03

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATING%
60	SWGR S	300	FDR 3	FDR	.04	92.96	393.22	40.42
60	SWGR S	400	FDR 4	FDR	.04	103.70	438.67	45.09
60	SWGR S	500	FDR 5	FDR	.03	65.44	276.83	28.45
62	SS-1 SEC	60	SWGR S	TX2	.01	.57	.48	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.57	.48	.12
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.57	.48	.12
64	MCC 4&5	68	BLUE SSS	FDR	.00	.87	.74	.19
64	MCC 4&5	90	SWGR O	TX2	.01	1.44	1.22	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.17	.74	.04
66	SM1A BLUE	68	BLUE SSS	TX2	.01	.17	.74	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.87	.74	.19
68	BLUE SSS	66	SM1A BLUE	TX2	.01	.87	.74	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.01	317.30	1342.29	68.24
70	SWGR N	90	SWGR O	FDR	.01	317.30	1342.29	85.76
80	UTILITY	85	T1 SEC	TX2	-1.81	65.61	2829.48	UNKNOW
85	T1 SEC	80	UTILITY	TX2	-1.81	646.64	2736.62	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.03	646.64	2736.62	174.77
90	SWGR O	64	MCC 4&5	TX2	.01	.29	1.22	UNKNOW
90	SWGR O	70	SWGR N	FDR	.01	317.30	1342.48	85.76
90	SWGR O	85	T1 SEC	FDR	.03	646.64	2735.86	174.77
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.05	122.07	516.45	53.07
90	SWGR O	800	FDR 8	FDR	.04	102.22	432.47	44.44
90	SWGR O	900	FDR 9	FDR	.04	109.31	462.49	47.53
100	FDR 1	60	SWGR S	FDR	.06	136.43	576.79	59.32
100	FDR 1	105	F1F12 14	FDR	1.83	136.43	576.79	38.22
105	F1F12 14	100	FDR 1	FDR	1.83	136.43	566.41	38.22
105	F1F12 14	110	F1 L14	FDR	.24	134.19	557.11	37.59
110	F1 L14	105	F1F12 14	FDR	.24	134.19	555.77	37.59
110	F1 L14	115	F1 L15	FDR	.02	6.29	26.05	1.76
110	F1 L14	120	F1 L31	FDR	.44	122.59	507.75	34.34
115	F1 L15	110	F1 L14	FDR	.02	6.29	26.05	1.76
120	F1 L31	110	F1 L14	FDR	.44	122.59	505.52	34.34
120	F1 L31	121	F1 L63	FDR	.27	66.83	275.56	18.72
121	F1 L63	120	F1 L31	FDR	.27	66.83	274.82	18.72
121	F1 L63	122	F1 L64	FDR	.04	24.47	100.64	6.85
121	F1 L63	125	F1 L67	FDR	.05	26.78	110.11	7.50
122	F1 L64	121	F1 L63	FDR	.04	24.47	100.60	6.85

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
125	F1 L67	121	F1 L63	FDR	.05	26.78	110.06	7.50
125	F1 L67	130	F1 L613	FDR	.05	7.74	31.83	2.17
125	F1 L67	135	F1 L68	FDR	.01	3.54	14.53	.99
130	F1 L613	125	F1 L67	FDR	.05	7.74	31.82	2.17
135	F1 L68	125	F1 L67	FDR	.01	3.54	14.53	.99
200	FDR 2	60	SWGR S	FDR	.05	133.46	564.24	58.03
200	FDR 2	205		FDR	.71	133.46	564.24	37.38
205		200	FDR 2	FDR	.71	133.46	560.29	37.38
205		210	2-3 PRI	FDR	.08	59.79	251.02	16.75
205		235	F5 F29	FDR	.20	56.07	235.40	15.71
210	2-3 PRI	205		FDR	.08	59.79	250.82	16.75
210	2-3 PRI	215	2-4 PRI	FDR	.02	37.30	156.47	10.45
210	2-3 PRI	225	2-3 SEC	TX2	.00	.00	.00	UNKNOW
215	2-4 PRI	210	2-3 PRI	FDR	.02	37.30	156.44	10.45
215	2-4 PRI	220	2-5 PRI	FDR	.03	14.81	62.12	4.15
215	2-4 PRI	230	2-4 SEC	TX2	.00	.00	.00	UNKNOW
220	2-5 PRI	215	2-4 PRI	FDR	.03	14.81	62.10	4.15
225	2-3 SEC	210	2-3 PRI	TX2	.00	.00	.00	UNKNOW
230	2-4 SEC	215	2-4 PRI	TX2	.00	.00	.00	UNKNOW
235	F5 F29	205		FDR	.20	56.07	234.94	15.71
235	F5 F29	236	F2 F211	FDR	.10	44.88	188.03	12.57
236	F2 F211	235	F5 F29	FDR	.10	44.88	187.85	12.57
236	F2 F211	240	F1 F213	FDR	.05	22.43	93.90	6.28
240	F1 F213	236	F2 F211	FDR	.05	22.43	93.85	6.28
300	FDR 3	60	SWGR S	FDR	.04	92.96	393.08	40.42
300	FDR 3	301	F8 F311	FDR	.33	92.96	393.08	26.04
301	F8 F311	300	FDR 3	FDR	.33	92.96	391.80	26.04
301	F8 F311	303	F713	FDR	.08	45.22	190.57	12.67
303	F713	301	F8 F311	FDR	.08	45.22	190.42	12.67
303	F713	305	F8 F311	FDR	.16	45.22	190.42	12.67
305	F8 F311	303	F713	FDR	.16	45.22	190.12	12.67
305	F8 F311	310	F3 19	FDR	.44	41.37	173.94	11.59
310	F3 19	305	F8 F311	FDR	.44	41.37	173.18	11.59
400	FDR 4	60	SWGR S	FDR	.04	103.70	438.48	45.09
400	FDR 4	401	4-1 PRI	FDR	.23	103.70	438.48	29.05
401	4-1 PRI	400	FDR 4	FDR	.23	103.70	437.49	29.05
401	4-1 PRI	403	F1 F45	FDR	.19	84.40	356.06	23.64
403	F1 F45	401	4-1 PRI	FDR	.19	84.40	355.40	23.64
403	F1 F45	405	F4 10	FDR	.24	53.16	223.85	14.89
405	F4 10	403	F1 F45	FDR	.24	53.16	223.33	14.89

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATINGX
405	F4 10	410	F417 UF1	FDR	.32	36.48	153.25	10.22
410	F417 UF1	405	F4 10	FDR	.32	36.48	152.75	10.22
410	F417 UF1	415	4-6 SEC	TX2	.00	.00	.00	UNKNOW
415	4-6 SEC	410	F417 UF1	TX2	.00	.00	.00	UNKNOW
500	FDR 5	60	SWGR S	FDR	.03	65.44	276.76	28.45
500	FDR 5	505	F4 F5 F6UF	FDR	.37	65.44	276.76	18.33
505	F4 F5 F6UF	500	FDR 5	FDR	.37	65.44	275.76	18.33
505	F4 F5 F6UF	510	5-1 PRI	FDR	.02	7.94	33.46	2.22
505	F4 F5 F6UF	512	5-3 PRI	FDR	.83	57.51	242.31	16.11
510	5-1 PRI	505	F4 F5 F6UF	FDR	.02	7.94	33.46	2.22
512	5-3 PRI	505	F4 F5 F6UF	FDR	.83	57.51	240.33	16.11
512	5-3 PRI	514	5-5 PRI	FDR	.01	1.30	5.44	.36
512	5-3 PRI	515	F5 L24	FDR	.56	52.61	219.87	14.74
514	5-5 PRI	512	5-3 PRI	FDR	.01	1.30	5.44	.36
515	F5 L24	512	5-3 PRI	FDR	.56	52.61	218.63	14.74
515	F5 L24	520	5-6 PRI	FDR	.04	1.29	5.37	1.23
515	F5 L24	525	F5 L31	FDR	.09	49.24	204.65	13.79
520	5-6 PRI	515	F5 L24	FDR	.04	1.29	5.37	1.23
525	F5 L31	515	F5 L24	FDR	.09	49.24	204.47	13.79
525	F5 L31	530	F5 L39	FDR	.02	1.28	5.33	.36
525	F5 L31	531	F3 L41	FDR	.11	24.24	100.64	6.79
525	F5 L31	535	F537 L5	FDR	.27	21.65	89.90	6.06
530	F5 L39	525	F5 L31	FDR	.02	1.28	5.33	.36
531	F3 L41	525	F5 L31	FDR	.11	24.24	100.53	6.79
531	F3 L41	535	F537 L5	FDR	.16	20.21	83.84	5.66
535	F537 L5	525	F5 L31	FDR	.27	21.65	89.66	6.06
535	F537 L5	531	F3 L41	FDR	.16	20.21	83.71	5.66
535	F537 L5	540	F5 L5 UF1	FDR	.01	4.09	16.94	1.15
535	F537 L5	555		FDR	.36	36.50	151.14	13.22
540	F5 L5 UF1	535	F537 L5	FDR	.01	4.09	16.94	1.15
540	F5 L5 UF1	545	F5 L56 UF1	FDR	.14	3.03	12.53	1.65
540	F5 L5 UF1	550	F5 L55	FDR	.01	.54	2.22	.15
545	F5 L56 UF1	540	F5 L5 UF1	FDR	.14	3.03	12.52	1.65
545	F5 L56 UF1	547	5-16 SEC	TX2	.00	.00	.00	UNKNOW
547	5-16 SEC	545	F5 L56 UF1	TX2	.00	.00	.00	UNKNOW
550	F5 L55	540	F5 L5 UF1	FDR	.01	.54	2.22	.15
555		535	F537 L5	FDR	.36	36.50	150.59	13.22
555		560	RICH SUB	FDR	.26	6.43	26.52	2.33
555		565	5-17 PRI	FDR	.30	30.07	124.07	10.90
560	RICH SUB	555		FDR	.26	6.43	26.45	2.33

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
560	RICH SUB	562	RS SEC	TX2	.12	6.43	26.45	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	2.14	26.42	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	2.14	26.42	1.53
565	5-17 PRI	555		FDR	.30	30.07	123.69	10.90
565	5-17 PRI	570	5-18 PRI	FDR	.01	2.06	8.47	.75
565	5-17 PRI	575	F5 51	FDR	.10	26.74	110.01	9.69
570	5-18 PRI	565	5-17 PRI	FDR	.01	2.06	8.46	.75
575	F5 51	565	5-17 PRI	FDR	.10	26.74	109.90	9.69
575	F5 51	580	F5 L85	FDR	.19	26.24	107.84	9.51
580	F5 L85	575	F5 51	FDR	.19	26.24	107.63	9.51
580	F5 L85	585	F5 L87 UF1	FDR	.03	6.00	24.62	2.17
580	F5 L85	590	F5 L8911	FDR	.15	18.20	74.65	13.00
585	F5 L87 UF1	580	F5 L85	FDR	.03	6.00	24.61	2.17
590	F5 L8911	580	F5 L85	FDR	.15	18.20	74.54	13.00
590	F5 L8911	591	5-23 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	593	5-24 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	595	F5 L8 25	FDR	.31	8.15	33.36	5.82
591	5-23 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
593	5-24 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
595	F5 L8 25	590	F5 L8911	FDR	.31	8.15	33.25	5.82
600	O/H BUS	90	SWGR 0	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR 0	FDR	.05	122.07	516.19	53.07
700	FDR 7	705	WELL9 POL	FDR	.05	122.07	516.19	34.19
705	WELL9 POL	700	FDR 7	FDR	.05	122.07	515.92	34.19
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.20	111.47	471.13	31.22
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.20	111.47	470.21	31.22
709	F9 F73	710	F7 L11	FDR	.80	90.16	380.34	25.26
710	F7 L11	709	F9 F73	FDR	.80	90.16	377.32	25.26
710	F7 L11	715	F7 L13	FDR	.02	5.36	22.43	1.50
710	F7 L11	720	F713	FDR	.28	63.36	265.15	17.75
715	F7 L13	710	F7 L11	FDR	.02	5.36	22.42	1.50
720	F713	710	F7 L11	FDR	.28	63.36	264.41	17.75
720	F713	725	7-15 PRI	FDR	.59	55.49	231.59	15.54
725	7-15 PRI	720	F713	FDR	.59	55.49	230.22	15.54
725	7-15 PRI	730	F7 L43	FDR	.02	3.04	12.60	.85
725	7-15 PRI	735	F7 L54	FDR	.09	29.23	121.25	8.19
730	F7 L43	725	7-15 PRI	FDR	.02	3.04	12.59	.85
735	F7 L54	725	7-15 PRI	FDR	.09	29.23	121.14	8.19

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
735	F7 L54	740	7-17 PRI	FDR	.03	4.25	17.61	1.19
735	F7 L54	745		FDR	.11	19.67	81.53	5.51
740	7-17 PRI	735	F7 L54	FDR	.03	4.25	17.61	1.19
745		735	F7 L54	FDR	.11	19.67	81.44	5.51
745		750	F7 L72	FDR	.03	7.04	29.16	1.97
745		760	7-21 PRI	FDR	.16	12.63	52.28	3.54
750	F7 L72	745		FDR	.03	7.04	29.16	1.97
750	F7 L72	755	F7-33	FDR	.01	1.74	7.22	.49
755	F7-33	750	F7 L72	FDR	.01	1.74	7.22	.49
760	7-21 PRI	745		FDR	.16	12.63	52.19	3.54
760	7-21 PRI	765	7-22 PRI	FDR	.05	9.60	39.69	2.69
765	7-22 PRI	760	7-21 PRI	FDR	.05	9.60	39.67	2.69
765	7-22 PRI	770	7-23 PRI	FDR	.03	4.31	17.80	1.21
770	7-23 PRI	765	7-22 PRI	FDR	.03	4.31	17.80	1.21
770	7-23 PRI	775	7-24 PRI	FDR	.02	3.02	12.49	.85
775	7-24 PRI	770	7-23 PRI	FDR	.02	3.02	12.48	.85
800	FDR 8	90	SWGR 0	FDR	.04	102.22	432.30	44.44
800	FDR 8	805	F8 L11	FDR	1.65	102.22	432.30	28.63
805	F8 L11	800	FDR 8	FDR	1.65	102.22	425.27	28.63
805	F8 L11	810	F8 L23	FDR	.85	94.60	393.60	26.50
810	F8 L23	805	F8 L11	FDR	.85	94.60	390.27	26.50
810	F8 L23	815	F8 L25	FDR	.01	1.08	4.44	.30
810	F8 L23	817	F8 22	FDR	.13	75.18	310.16	21.06
815	F8 L25	810	F8 L23	FDR	.01	1.08	4.44	.30
817	F8 22	810	F8 L23	FDR	.13	75.18	309.74	21.06
817	F8 22	820	F8 30 UF1	FDR	.63	64.10	264.08	17.96
820	F8 30 UF1	817	F8 22	FDR	.63	64.10	262.41	17.96
820	F8 30 UF1	825	8-22 PRI	FDR	.53	35.18	144.03	9.86
825	8-22 PRI	820	F8 30 UF1	FDR	.53	35.18	143.25	9.86
900	FDR 9	90	SWGR 0	FDR	.04	109.31	462.29	47.53
900	FDR 9	905	STEP SEC	TX2	.67	109.31	462.29	UNKNOWN
905	STEP SEC	900	FDR 9	TX2	.67	36.44	459.23	UNKNOWN
905	STEP SEC	910	F 96	FDR	.07	36.44	459.23	10.21
910	F 96	905	STEP SEC	FDR	.07	36.44	458.94	10.21
910	F 96	915	F910	FDR	.08	34.92	439.82	9.78
915	F910	910	F 96	FDR	.08	34.92	439.46	9.78
915	F910	920	F940	FDR	.40	29.84	375.56	8.36
920	F940	915	F910	FDR	.40	29.84	374.07	8.36
920	F940	945	F949 L1	FDR	.07	28.97	363.14	8.11
925	()	930	RICH SUB	FDR	.04	2.14	26.41	1.53

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATING%
925	()	935	9-8 PRI	FDR	.04	2.14	26.41	2.04
930	RICH SUB	562	RS SEC	FDR	.00	2.14	26.42	1.53
930	RICH SUB	925	()	FDR	.04	2.14	26.42	1.53
935	9-8 PRI	925	()	FDR	.04	2.14	26.40	2.04
935	9-8 PRI	940	9-9 PRI	FDR	.11	1.29	15.84	1.22
940	9-9 PRI	935	9-8 PRI	FDR	.11	1.29	15.82	1.22
945	F949 L1	920	F940	FDR	.07	28.97	362.89	8.11
945	F949 L1	950	9-12 PRI	FDR	.02	.70	8.73	.66
945	F949 L1	960	9-13 PRI	FDR	.45	27.82	348.48	15.12
950	9-12 PRI	945	F949 L1	FDR	.02	.70	8.72	.66
950	9-12 PRI	955	9-11 PRI	FDR	.01	.35	4.36	.33
955	9-11 PRI	950	9-12 PRI	FDR	.01	.35	4.36	.33
960	9-13 PRI	945	F949 L1	FDR	.45	27.82	346.93	15.12
960	9-13 PRI	963	9-14 PRI	FDR	1.46	26.32	328.18	14.30
963	9-14 PRI	960	9-13 PRI	FDR	1.46	26.32	323.39	14.30
963	9-14 PRI	966	9-15 PRI	FDR	.40	24.84	305.19	13.50
966	9-15 PRI	963	9-14 PRI	FDR	.40	24.84	303.95	13.50
966	9-15 PRI	969	SW UP	FDR	.11	24.66	301.86	13.40
969	SW UP	966	9-15 PRI	FDR	.11	24.66	301.53	13.40
969	SW UP	972	SW DOWN	FDR	.00	24.66	301.53	5.30
972	SW DOWN	969	SW UP	FDR	.00	24.66	301.53	5.30
972	SW DOWN	975	9-16 PRI	FDR	1.51	24.66	301.53	13.40
975	9-16 PRI	972	SW DOWN	FDR	1.51	24.66	296.88	13.40
975	9-16 PRI	977	9-19 PRI	FDR	.10	1.34	16.12	.73
975	9-16 PRI	980		FDR	.60	23.33	280.76	12.68
977	9-19 PRI	975	9-16 PRI	FDR	.10	1.34	16.10	.73
980		975	9-16 PRI	FDR	.60	23.33	279.03	12.68
980		982	9-20 PRI	FDR	.01	.50	5.98	.27
980		983	9-25 PRI	FDR	1.00	22.83	273.05	12.41
982	9-20 PRI	980		FDR	.01	.50	5.98	.27
983	9-25 PRI	980		FDR	1.00	22.83	270.20	12.41
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.14	9.80	115.98	5.32
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.14	9.80	115.81	5.32
985	9-34 PRI	987		FDR	.42	8.94	105.70	4.86
987		985	9-34 PRI	FDR	.42	8.94	105.23	4.86
987		990	9-26 PRI	FDR	.26	3.67	43.16	1.99
987		992		FDR	1.04	5.27	62.07	2.87
990	9-26 PRI	987		FDR	.26	3.67	43.04	1.99

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CASE 1 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM NAME	TO NAME	TYPE	VD%	AMPS	KVA	RATING%
992	987	FDR	1.04	5.27	61.39	2.87
992	995 9-30 PRI	FDR	.73	3.62	42.12	3.02
992	997 9-32 PRI	FDR	.06	1.66	19.27	.90
995 9-30 PRI	992	FDR	.73	3.62	41.79	3.02
997 9-32 PRI	992	FDR	.06	1.66	19.25	.90

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

127 BUSES

*** TOTAL SYSTEM LOSSES ***
76.1 KW 239.2 KVAR

WARNING STUDY CONTAINS 8 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY (\$) AT BUS AND BRANCH %VD LOCATIONS



APPENDIX G

Load Flow Analysis - Case 2

CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREEELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 20 NOV 95
TIME: 4 52 PM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)
COPYRIGHT SKM SYSTEMS ANALYSIS, INC. 1983

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS
BUS NO ID STAT VOLTAGE ANGLE
=====

80	6 1	1.000	.000
----	-----	-------	------

PV GENERATORS
BUS NO ID STAT VOLTAGE kW KVARMIN KVARMAX PARTICIPATION
=====

10	1 1	1.000	1000.	0.	0.	1.000
20	2 1	1.000	0.	0.	0.	1.000
30	3 1	1.000	0.	0.	0.	1.000
40	4 1	1.000	0.	0.	0.	1.000
50	5 1	1.000	0.	0.	0.	1.000

NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
10 GEN G1 IMPEDANCE:	15 G1 STEP-UP .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
20 GEN G2 IMPEDANCE:	25 G2 STEP-UP .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
30 GEN G3 IMPEDANCE:	35 G3 STEP-UP .0300 + J	1 .0526 OHMS/M FEET	2400.	50. FT	500	C M XLP STATUS: EXISTING
40 GEN G4 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	4160.	50. FT	500	C M XLP STATUS: EXISTING
50 GEN G5 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	4160.	50. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	66 SM1A BLUE .0300 + J	1 .0526 OHMS/M FEET	4160.	50. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M FEET	4160.	5. FT	500	C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	100 FDR 1 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	200 FDR 2 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	300 FDR 3 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	400 FDR 4 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	500 FDR 5 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
62 SS-1 SEC IMPEDANCE:	64 MCC 4&5 .0300 + J	1 .0526 OHMS/M FEET	480.	50. FT	500	C M XLP STATUS: EXISTING
64 MCC 4&5 IMPEDANCE:	68 BLUE SSS .0300 + J	1 .0526 OHMS/M FEET	480.	50. FT	500	C M XLP STATUS: EXISTING
70 SWGR N IMPEDANCE:	90 SWGR O .0453 + J	1 .0444 OHMS/M FEET	4160.	10. FT	500	A M XLP STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
85 T1 SEC IMPEDANCE:	90 SWGR O .0453 + J	1 .0444 OHMS/M FEET	4160.	10. FT	500	A M XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	600 O/H BUS .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	700 FDR 7 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	800 FDR 8 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	900 FDR 9 .1050 + J	1 .0410 OHMS/M FEET	4160.	50. FT	4/0	A N XLP STATUS: EXISTING
100 FDR 1 IMPEDANCE:	105 F1F12 14 .0900 + J	1 .1200 OHMS/M FEET	4160.	1500. FT	4/0	A B OH-2 STATUS: EXISTING
105 F1F12 14 IMPEDANCE:	110 F1 L14 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	115 F1 L15 .0900 + J	1 .1200 OHMS/M FEET	4160.	300. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	120 F1 L31 .0900 + J	1 .1200 OHMS/M FEET	4160.	400. FT	4/0	A B OH-2 STATUS: EXISTING
120 F1 L31 IMPEDANCE:	121 F1 L63 .0900 + J	1 .1200 OHMS/M FEET	4160.	450. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	122 F1 L64 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	125 F1 L67 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
125 F1 L67 IMPEDANCE:	130 F1 L613 .0900 + J	1 .1200 OHMS/M FEET	4160.	700. FT	4/0	A B OH-2 STATUS: EXISTING
125 F1 L67 IMPEDANCE:	135 F1 L68 .0900 + J	1 .1200 OHMS/M FEET	4160.	300. FT	4/0	A B OH-2 STATUS: EXISTING
200 FDR 2 IMPEDANCE:	205 .0900 + J	1 .1200 OHMS/M FEET	4160.	600. FT	4/0	A B OH-2 STATUS: EXISTING

DATE: 20 NOV 95 TIME: 4 52 PM PAGE 5
CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
205 IMPEDANCE:	210 2-3 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	150. FT	4/0	A B OH-2 STATUS: EXISTING
205 IMPEDANCE:	235 F5 F29 .0900 + J	1 .1200 OHMS/M FEET	4160.	400. FT	4/0	A B OH-2 STATUS: EXISTING
210 2-3 PRI IMPEDANCE:	215 2-4 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	50. FT	4/0	A B OH-2 STATUS: EXISTING
215 2-4 PRI IMPEDANCE:	220 2-5 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
235 F5 F29 IMPEDANCE:	236 F2 F211 .0900 + J	1 .1200 OHMS/M FEET	4160.	250. FT	4/0	A B OH-2 STATUS: EXISTING
236 F2 F211 IMPEDANCE:	240 F1 F213 .0900 + J	1 .1200 OHMS/M FEET	4160.	250. FT	4/0	A B OH-2 STATUS: EXISTING
300 FDR 3 IMPEDANCE:	301 F8 F311 .0900 + J	1 .1200 OHMS/M FEET	4160.	400. FT	4/0	A B OH-2 STATUS: EXISTING
301 F8 F311 IMPEDANCE:	303 F713 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
303 F713 IMPEDANCE:	305 F8 F311 .0900 + J	1 .1200 OHMS/M FEET	4160.	400. FT	4/0	A B OH-2 STATUS: EXISTING
305 F8 F311 IMPEDANCE:	310 F3 19 .0900 + J	1 .1200 OHMS/M FEET	4160.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
400 FDR 4 IMPEDANCE:	401 4-1 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	250. FT	4/0	A B OH-2 STATUS: EXISTING
401 4-1 PRI IMPEDANCE:	403 F1 F45 .0900 + J	1 .1200 OHMS/M FEET	4160.	250. FT	4/0	A B OH-2 STATUS: EXISTING
403 F1 F45 IMPEDANCE:	405 F4 10 .0900 + J	1 .1200 OHMS/M FEET	4160.	500. FT	4/0	A B OH-2 STATUS: EXISTING
405 F4 10 IMPEDANCE:	410 F417 UF1 .0900 + J	1 .1200 OHMS/M FEET	4160.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
500 FDR 5 IMPEDANCE:	505 F4 F5 F6UF .0900 + J	1 .1200 OHMS/M FEET	4160.	625. FT	4/0	A B OH-2 STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
505 F4 F5 F6UF IMPEDANCE: .0900 + J .1200 OHMS/M FEET	510 5-1 PRI	1	4160.	250. FT	4/0	A B OH-2 STATUS: EXISTING
505 F4 F5 F6UF IMPEDANCE: .0900 + J .1200 OHMS/M FEET	512 5-3 PRI	1	4160.	1600. FT	4/0	A B OH-2 STATUS: EXISTING
512 5-3 PRI IMPEDANCE: .0900 + J .1200 OHMS/M FEET	514 5-5 PRI	1	4160.	700. FT	4/0	A B OH-2 STATUS: EXISTING
512 5-3 PRI IMPEDANCE: .0900 + J .1200 OHMS/M FEET	515 F5 L24	1	4160.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
515 F5 L24 IMPEDANCE: .6900 + J .1440 OHMS/M FEET	520 5-6 PRI	1	4160.	600. FT	6	A B OH-2 STATUS: EXISTING
515 F5 L24 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	525 F5 L31	1	4160.	200. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	530 F5 L39	1	4160.	1500. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	531 F3 L41	1	4160.	500. FT	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	535 F537 L5	1	4160.	1400. FT	4/0	A B OH-2 STATUS: EXISTING
531 F3 L41 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	535 F537 L5	1	4160.	900. FT	4/0	A B OH-2 STATUS: EXISTING
535 F537 L5 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	540 F5 L5 UF1	1	4160.	150. FT	4/0	A B OH-2 STATUS: EXISTING
535 F537 L5 IMPEDANCE: .1410 + J .1250 OHMS/M FEET	555	1	4160.	800. FT	2/0	A B OH-2 STATUS: EXISTING
540 F5 L5 UF1 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	545 F5 L56 UF1	1	4160.	2100. FT	2	A B OH-2 STATUS: EXISTING
540 F5 L5 UF1 IMPEDANCE: .0900 + J .1200 OHMS/M FEET	550 F5 L55	1	4160.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
555 IMPEDANCE: .1410 + J .1250 OHMS/M FEET	560 RICH SUB	1	4160.	3200. FT	2/0	A B OH-2 STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
555 IMPEDANCE:	565 5-17 PRI .1410 + J	1 .1250 OHMS/M FEET	4160.	800. FT	2/0 A B OH-2 STATUS: EXISTING
562 RS SEC IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	13200.	5. FT	4 A B OH-3 STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	570 5-18 PRI .1410 + J	1 .1250 OHMS/M FEET	4160.	400. FT	2/0 A B OH-2 STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	575 F5 51 .1410 + J	1 .1250 OHMS/M FEET	4160.	300. FT	2/0 A B OH-2 STATUS: EXISTING
575 F5 51 IMPEDANCE:	580 F5 L85 .1410 + J	1 .1250 OHMS/M FEET	4160.	600. FT	2/0 A B OH-2 STATUS: EXISTING
580 F5 L85 IMPEDANCE:	585 F5 L87 UF1 .1410 + J	1 .1250 OHMS/M FEET	4160.	350. FT	2/0 A B OH-2 STATUS: EXISTING
580 F5 L85 IMPEDANCE:	590 F5 L8911 .4360 + J	1 .1380 OHMS/M FEET	4160.	250. FT	4 A B OH-2 STATUS: EXISTING
590 F5 L8911 IMPEDANCE:	595 F5 L8 25 .4360 + J	1 .1380 OHMS/M FEET	4160.	1150. FT	4 A B OH-2 STATUS: EXISTING
700 FDR 7 IMPEDANCE:	705 WELL9 POL .0900 + J	1 .1200 OHMS/M FEET	4160.	50. FT	4/0 A B OH-2 STATUS: EXISTING
705 WELL9 POL IMPEDANCE:	709 F9 F73 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0 A B OH-2 STATUS: EXISTING
709 F9 F73 IMPEDANCE:	710 F7 L11 .0900 + J	1 .1200 OHMS/M FEET	4160.	1000. FT	4/0 A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE:	715 F7 L13 .0900 + J	1 .1200 OHMS/M FEET	4160.	500. FT	4/0 A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE:	720 F713 .0900 + J	1 .1200 OHMS/M FEET	4160.	500. FT	4/0 A B OH-2 STATUS: EXISTING
720 F713 IMPEDANCE:	725 7-15 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	1200. FT	4/0 A B OH-2 STATUS: EXISTING
725 7-15 PRI IMPEDANCE:	730 F7 L43 .0900 + J	1 .1200 OHMS/M FEET	4160.	600. FT	4/0 A B OH-2 STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
725 7-15 PRI IMPEDANCE: .0900 + J	735 F7 L54 .1200 OHMS/M FEET	1	4160.	350. FT	4/0	A B	OH-2	STATUS: EXISTING
735 F7 L54 IMPEDANCE: .0900 + J	740 7-17 PRI .1200 OHMS/M FEET	1	4160.	700. FT	4/0	A B	OH-2	STATUS: EXISTING
735 F7 L54 IMPEDANCE: .0900 + J	745 .1200 OHMS/M FEET	1	4160.	625. FT	4/0	A B	OH-2	STATUS: EXISTING
745 IMPEDANCE: .0900 + J	750 F7 L72 .1200 OHMS/M FEET	1	4160.	525. FT	4/0	A B	OH-2	STATUS: EXISTING
745 IMPEDANCE: .0900 + J	760 7-21 PRI .1200 OHMS/M FEET	1	4160.	1400. FT	4/0	A B	OH-2	STATUS: EXISTING
750 F7 L72 IMPEDANCE: .0900 + J	755 F7-33 .1200 OHMS/M FEET	1	4160.	800. FT	4/0	A B	OH-2	STATUS: EXISTING
760 7-21 PRI IMPEDANCE: .0900 + J	765 7-22 PRI .1200 OHMS/M FEET	1	4160.	600. FT	4/0	A B	OH-2	STATUS: EXISTING
765 7-22 PRI IMPEDANCE: .0900 + J	770 7-23 PRI .1200 OHMS/M FEET	1	4160.	700. FT	4/0	A B	OH-2	STATUS: EXISTING
770 7-23 PRI IMPEDANCE: .0900 + J	775 7-24 PRI .1200 OHMS/M FEET	1	4160.	700. FT	4/0	A B	OH-2	STATUS: EXISTING
800 FDR 8 IMPEDANCE: .0900 + J	805 F8 L11 .1200 OHMS/M FEET	1	4160.	1800. FT	4/0	A B	OH-2	STATUS: EXISTING
805 F8 L11 IMPEDANCE: .0900 + J	810 F8 L23 .1200 OHMS/M FEET	1	4160.	1000. FT	4/0	A B	OH-2	STATUS: EXISTING
810 F8 L23 IMPEDANCE: .0900 + J	815 F8 L25 .1200 OHMS/M FEET	1	4160.	700. FT	4/0	A B	OH-2	STATUS: EXISTING
810 F8 L23 IMPEDANCE: .0900 + J	817 F8 22 .1200 OHMS/M FEET	1	4160.	200. FT	4/0	A B	OH-2	STATUS: EXISTING
817 F8 22 IMPEDANCE: .0900 + J	820 F8 30 UF1 .1200 OHMS/M FEET	1	4160.	1100. FT	4/0	A B	OH-2	STATUS: EXISTING
820 F8 30 UF1 IMPEDANCE: .0900 + J	825 8-22 PRI .1200 OHMS/M FEET	1	4160.	1700. FT	4/0	A B	OH-2	STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
905 STEP SEC IMPEDANCE:	910 F 96 .0900 + J	1 .1200 OHMS/M FEET	13200.	600. FT	4/0 A B OH-3 STATUS: EXISTING
910 F 96 IMPEDANCE:	915 F910 .0900 + J	1 .1200 OHMS/M FEET	13200.	800. FT	4/0 A B OH-3 STATUS: EXISTING
915 F910 IMPEDANCE:	920 F940 .0900 + J	1 .1200 OHMS/M FEET	13200.	4500. FT	4/0 A B OH-3 STATUS: EXISTING
920 F940 IMPEDANCE:	945 F949 L1 .0900 + J	1 .1200 OHMS/M FEET	13200.	800. FT	4/0 A B OH-3 STATUS: EXISTING
925 () IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	13200.	1500. FT	4 A B OH-3 STATUS: EXISTING
925 () IMPEDANCE:	935 9-8 PRI .6900 + J	1 .1440 OHMS/M FEET	13200.	1000. FT	6 A B OH-3 STATUS: EXISTING
935 9-8 PRI IMPEDANCE:	940 9-9 PRI .6900 + J	1 .1440 OHMS/M FEET	13200.	5000. FT	6 A B OH-3 STATUS: EXISTING
945 F949 L1 IMPEDANCE:	950 9-12 PRI .6900 + J	1 .1440 OHMS/M FEET	13200.	2100. FT	6 A B OH-3 STATUS: EXISTING
945 F949 L1 IMPEDANCE:	960 9-13 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	2200. FT	2 A B OH-3 STATUS: EXISTING
950 9-12 PRI IMPEDANCE:	955 9-11 PRI .6900 + J	1 .1440 OHMS/M FEET	13200.	1800. FT	6 A B OH-3 STATUS: EXISTING
960 9-13 PRI IMPEDANCE:	963 9-14 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	7600. FT	2 A B OH-3 STATUS: EXISTING
963 9-14 PRI IMPEDANCE:	966 9-15 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	2200. FT	2 A B OH-3 STATUS: EXISTING
966 9-15 PRI IMPEDANCE:	969 SW UP .2760 + J	1 .1320 OHMS/M FEET	13200.	600. FT	2 A B OH-3 STATUS: EXISTING
969 SW UP IMPEDANCE:	972 SW DOWN .0300 + J	1 .0526 OHMS/M FEET	13200.	5. FT	500 C M XLP STATUS: EXISTING
972 SW DOWN IMPEDANCE:	975 9-16 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	8400. FT	2 A B OH-3 STATUS: EXISTING

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

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FEEDER FROM    FEEDER TO    QTY VOLTS   LENGTH    FEEDER DESCRIPTION
NO NAME        NO NAME    /PH L-L            SIZE TYPE DUCT INSUL
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975 9-16 PRI	977 9-19 PRI	1	13200.	10000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
975 9-16 PRI	980	1	13200.	3500. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
980	982 9-20 PRI	1	13200.	2000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
980	983 9-25 PRI	1	13200.	6000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
983 9-25 PRI	985 9-34 PRI	1	13200.	2000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
985 9-34 PRI	987	1	13200.	6400. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
987	990 9-26 PRI	1	13200.	9800. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
987	992	1	13200.	27000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		
992	995 9-30 PRI	1	13200.	25000. FT	2	A	N	XLP
IMPEDANCE:	.3350 + J	.0500	OHMS/M	FEET		STATUS: EXISTING		
992	997 9-32 PRI	1	13200.	5000. FT	2	A	B	OH-3
IMPEDANCE:	.2760 + J	.1320	OHMS/M	FEET		STATUS: EXISTING		

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

TRANSFORMER DATA

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
15 G1 STEP-UP IMPEDANCE: 1.0000 + J 5.6623 PERCENT	2400.	361.	60 SWGR S	4160.	208.	1500.0
25 G2 STEP-UP IMPEDANCE: 1.0000 + J 5.6623 PERCENT	2400.	361.	60 SWGR S	4160.	208.	1500.0
35 G3 STEP-UP IMPEDANCE: 1.0000 + J 5.6623 PERCENT	2400.	361.	60 SWGR S	4160.	208.	1500.0
60 SWGR S IMPEDANCE: .7816 + J 4.5331 PERCENT	4160.	42.	62 SS-1 SEC	480.	361.	300.0
66 SM1A BLUE IMPEDANCE: .8156 + J 4.7302 PERCENT	4160.	69.	68 BLUE SSS	480.	601.	500.0
80 UTILITY IMPEDANCE: .5546 + J 5.9341 PERCENT	24900.	58.	85 T1 SEC	4160.	347.	2500.0
90 SWGR O IMPEDANCE: .5709 + J 3.3111 PERCENT	4160.	42.	64 MCC 4&5	480.	361.	300.0
210 2-3 PRI IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	31.	225 2-3 SEC	480.	271.	225.0
215 2-4 PRI IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	31.	230 2-4 SEC	208.	625.	225.0
410 F417 UF1 IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	69.	415 4-6 SEC	208.	1388.	500.0
545 F5 L56 UF1 IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	16.	547 5-16 SEC	208.	312.	112.5
560 RICH SUB IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	83.	562 RS SEC	13200.	26.	600.0
590 F5 L8911 IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	7.	591 5-23 SEC	208.	139.	50.0
590 F5 L8911 IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	16.	593 5-24 SEC	208.	312.	112.5
705 WELL9 POL IMPEDANCE: .9345 + J 5.4200 PERCENT	4160.	21.	707 7-1 SEC	480.	180.	150.0

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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T R A N S F O R M E R D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
900 FDR 9 IMPEDANCE:	4160. .7816 + J 4.5331	208. PERCENT	905 STEP SEC	13200.	66.	1500.0
983 9-25 PRI IMPEDANCE:	13200. .9345 + J 5.4200	22. PERCENT	984 9-25 SEC	208.	1388.	500.0

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S S P E C I A L S T U D Y D A T A

* NO *	NAME	* KW	* KVAR	* LOAD TYPE
105	F1F12 14	9.	3.	CONSTANT Z LOAD
110	F1 L14	21.	7.	CONSTANT Z LOAD
115	F1 L15	25.	8.	CONSTANT Z LOAD
120	F1 L31	222.	73.	CONSTANT Z LOAD
121	F1 L63	62.	21.	CONSTANT Z LOAD
122	F1 L64	98.	32.	CONSTANT Z LOAD
125	F1 L67	62.	20.	CONSTANT Z LOAD
130	F1 L613	31.	10.	CONSTANT Z LOAD
135	F1 L68	14.	5.	CONSTANT Z LOAD
205		69.	22.	CONSTANT Z LOAD
210	2-3 PRI	88.	29.	CONSTANT Z LOAD
215	2-4 PRI	88.	29.	CONSTANT Z LOAD
220	2-5 PRI	58.	19.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
301	F8 F311	186.	61.	CONSTANT Z LOAD
305	F8 F311	15.	5.	CONSTANT Z LOAD
310	F3 19	162.	54.	CONSTANT Z LOAD
401	4-1 PRI	75.	25.	CONSTANT Z LOAD
403	F1 F45	125.	41.	CONSTANT KVA LOAD
405	F4 10	65.	22.	CONSTANT Z LOAD
410	F417 UF1	143.	47.	CONSTANT Z LOAD
510	5-1 PRI	31.	10.	CONSTANT Z LOAD
512	5-3 PRI	14.	5.	CONSTANT Z LOAD
514	5-5 PRI	5.	2.	CONSTANT Z LOAD
515	F5 L24	8.	3.	CONSTANT Z LOAD
520	5-6 PRI	5.	2.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
530	F5 L39	5.	2.	CONSTANT Z LOAD
531	F3 L41	16.	5.	CONSTANT Z LOAD
535	F537 L5	5.	2.	CONSTANT Z LOAD
540	F5 L5 UF1	2.	1.	CONSTANT Z LOAD
545	F5 L56 UF1	12.	4.	CONSTANT Z LOAD
550	F5 L55	2.	1.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
570	5-18 PRI	8.	3.	CONSTANT Z LOAD
575	F5 51	2.	1.	CONSTANT Z LOAD

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
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B U S S P E C I A L S T U D Y D A T A

* NO	* NAME	* KW	* KVAR	* LOAD TYPE
580	F5 L85	8.	3.	CONSTANT Z LOAD
585	F5 L87 UF1	24.	8.	CONSTANT Z LOAD
590	F5 L8911	41.	11.	CONSTANT Z LOAD
595	F5 L8 25	33.	10.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	84.	28.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
720	F713	31.	10.	CONSTANT Z LOAD
725	7-15 PRI	92.	30.	CONSTANT Z LOAD
730	F7 L43	12.	4.	CONSTANT Z LOAD
735	F7 L54	21.	7.	CONSTANT Z LOAD
740	7-17 PRI	17.	5.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
755	F7-33	7.	2.	CONSTANT Z LOAD
760	7-21 PRI	12.	4.	CONSTANT Z LOAD
765	7-22 PRI	21.	7.	CONSTANT Z LOAD
770	7-23 PRI	5.	2.	CONSTANT Z LOAD
775	7-24 PRI	12.	4.	CONSTANT Z LOAD
805	F8 L11	30.	10.	CONSTANT Z LOAD
810	F8 L23	73.	24.	CONSTANT Z LOAD
815	F8 L25	4.	1.	CONSTANT Z LOAD
817	F8 22	44.	15.	CONSTANT Z LOAD
820	F8 30 UF1	116.	38.	CONSTANT Z LOAD
825	8-22 PRI	136.	45.	CONSTANT KVA LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
915	F910	60.	20.	CONSTANT Z LOAD
920	F940	10.	3.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	5.	2.	CONSTANT Z LOAD
950	9-12 PRI	4.	1.	CONSTANT Z LOAD
955	9-11 PRI	4.	1.	CONSTANT Z LOAD
960	9-13 PRI	18.	6.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
966	9-15 PRI	2.	1.	CONSTANT Z LOAD
977	9-19 PRI	16.	5.	CONSTANT Z LOAD
982	9-20 PRI	6.	2.	CONSTANT Z LOAD

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

B U S S P E C I A L S T U D Y D A T A

* NO *	NAME	* KW	* KVAR	* LOAD TYPE
983 9-25 PRI		163.	53.	CONSTANT Z LOAD
985 9-34 PRI		11.	4.	CONSTANT Z LOAD
990 9-26 PRI		46.	15.	CONSTANT Z LOAD
995 9-30 PRI		46.	15.	CONSTANT Z LOAD
997 9-32 PRI		21.	7.	CONSTANT Z LOAD

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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*** SOLUTION COMMENTS ***
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SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS:	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 472

LARGEST LOAD:	1000.00 KVA	
CONVERGENCE CRITERIA:	.050 KVA	
LARGEST BUS MISMATCH	10 GEN G1	47.552 KVA
LARGEST BUS MISMATCH	10 GEN G1	2.699 KVA
LARGEST BUS MISMATCH	10 GEN G1	.155 KVA
LARGEST BUS MISMATCH	10 GEN G1	.009 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	2533.1	1392.9	.0	

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)

BUS NAME	ID	---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
		SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.023	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.017	.0	.0	.0	.0
30 GEN G3	3	1.000	1.017	.0	.0	.0	.0
40 GEN G4	4	1.000	1.017	.0	.0	.0	.0
50 GEN G5	5	1.000	1.017	.0	.0	.0	.0

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 10 GEN G1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2456 %VD: -2.3
===== PU BUS VOLTAGE: 1.023 ANGLE: -1.0 DEGREES
 ** PV TYPE GENERATOR: 1 1000.0 KW .0 KVAR

LOAD TO: 15 G1 STEP-UP FEEDER AMPS: 235 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 1000.0 KW .0 KVAR 1000.0 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

==== BUS: 15 G1 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2455 %VD: -2.3
===== PU BUS VOLTAGE: 1.023 ANGLE: -1.0 DEGREES

LOAD FROM: 10 GEN G1 FEEDER AMPS: 235 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 999.8 KW -.4 KVAR 999.8 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

LOAD TO: 60 SWGR S TRANSF AMPS: 235 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 999.8 KW -.4 KVAR 999.8 KVA PF:1.00 UNITY
LOSSES THRU TRANSF: 6.4 KW 36.1 KVAR 36.6 KVA

==== BUS: 20 GEN G2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
 ** PV TYPE GENERATOR: 2 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 25 G2 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 30 GEN G3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
 ** PV TYPE GENERATOR: 3 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 35 G3 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2441 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 40 GEN G4 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
** PV TYPE GENERATOR: 4 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 50 GEN G5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
** PV TYPE GENERATOR: 5 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 60 SWGR S DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 15 G1 STEP-UP TRANSF AMPS: 136 VOLTAGE DROP: 24. %VD: .6
PROJECTED POWER FLOW: 993.4 KW -36.5 KVAR 994.1 KVA PF:1.00 UNITY
LOSSES THRU TRANSF: 6.4 KW 36.1 KVAR 36.6 KVA

LOAD FROM: 25 G2 STEP-UP TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 35 G3 STEP-UP TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 62 SS-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .1 KVAR .2 KVA PF: .45 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 66 SM1A BLUE FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 70 SWGR N FEEDER AMPS: 189 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1159.6 KW 753.7 KVAR 1383.0 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 100 FDR 1 FEEDER AMPS: 80 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 556.5 KW 186.4 KVAR 586.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 200 FDR 2 FEEDER AMPS: 77 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 539.1 KW 177.5 KVAR 567.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 300 FDR 3 FEEDER AMPS: 54 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 374.5 KW 124.4 KVAR 394.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 400 FDR 4 FEEDER AMPS: 60 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 417.1 KW 138.7 KVAR 439.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 500 FDR 5 FEEDER AMPS: 38 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 266.0 KW 90.6 KVAR 281.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 62 SS-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 64 MCC 4&5 DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD TO: 62 SS-1 SEC FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .1 KVAR .2 KVA PF: .45 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 68 BLUE SSS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 90 SWGR 0 TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .4 KVA PF: .45 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 66 SM1A BLUE DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD TO: 60 SWGR S FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 68 BLUE SSS TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 68 BLUE SSS DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 64 MCC 4&5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 66 SM1A BLUE TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .2 KVAR .3 KVA PF: .46 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 70 SWGR N DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 40 GEN G4 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 50 GEN G5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 60 SWGR S FEEDER AMPS: 189 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1159.6 KW 753.7 KVAR 1383.0 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 90 SWGR O FEEDER AMPS: 189 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1159.6 KW 753.7 KVAR 1383.0 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 80 UTILITY DESIGN VOLTAGE: 24900 BUS VOLTAGE: 24900 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: .0 DEGREES
*** SWING GENERATOR: 6 2533.1 KW 1392.9 KVAR

LOAD TO: 85 T1 SEC TRANSF AMPS: 67 VOLTAGE DROP: -431. %VD: -1.7
PROJECTED POWER FLOW: 2533.1 KW 1392.9 KVAR 2890.8 KVA PF: .88 LAGGING
LOSSES THRU TRANSF: 16.7 KW 179.0 KVAR 179.8 KVA **XFMR TAPS -5.0%**

==== BUS: 85 T1 SEC DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4232 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 80 UTILITY TRANSF AMPS: 381 VOLTAGE DROP: -72. %VD: -1.7
PROJECTED POWER FLOW: 2516.3 KW 1213.9 KVAR 2793.8 KVA PF: .90 LAGGING
LOSSES THRU TRANSF: 16.7 KW 179.0 KVAR 179.8 KVA **XFMR TAPS -5.0%**

LOAD TO: 90 SWGR 0 FEEDER AMPS: 381 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 2516.3 KW 1213.9 KVAR 2793.8 KVA PF: .90 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 90 SWGR 0 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4232 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD TO: 64 MCC 4&5 TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .4 KVAR .4 KVA PF: .45 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 70 SWGR N FEEDER AMPS: 189 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 1159.7 KW 753.7 KVAR 1383.1 KVA PF: .84 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD FROM: 85 T1 SEC FEEDER AMPS: 381 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 2516.1 KW 1213.7 KVAR 2793.6 KVA PF: .90 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 600 O/H BUS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 700 FDR 7 FEEDER AMPS: 71 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 493.9 KW 164.3 KVAR 520.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 800 FDR 8 FEEDER AMPS: 59 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 410.8 KW 139.1 KVAR 433.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 900 FDR 9 FEEDER AMPS: 65 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 451.6 KW 156.2 KVAR 477.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 100 FDR 1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 80 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 556.4 KW 186.4 KVAR 586.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 105 F1F12 14 FEEDER AMPS: 80 VOLTAGE DROP: 26. %VD: .6
PROJECTED POWER FLOW: 556.4 KW 186.4 KVAR 586.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.6 KW 3.5 KVAR 4.3 KVA

==== BUS: 105 F1F12 14 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4205 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 9.2 KW 2.6 KVAR

LOAD FROM: 100 FDR 1 FEEDER AMPS: 80 VOLTAGE DROP: 26. %VD: .6
PROJECTED POWER FLOW: 553.8 KW 182.9 KVAR 583.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.6 KW 3.5 KVAR 4.3 KVA

LOAD TO: 110 F1 L14 FEEDER AMPS: 79 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 544.6 KW 180.3 KVAR 573.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .6 KVA

==== BUS: 110 F1 L14 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4202 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 21.4 KW 7.1 KVAR

LOAD FROM: 105 F1F12 14 FEEDER AMPS: 79 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 544.3 KW 179.9 KVAR 573.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .6 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 115 F1 L15 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 25.5 KW 8.2 KVAR 26.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 120 F1 L31 FEEDER AMPS: 72 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 497.3 KW 164.6 KVAR 523.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .7 KVAR .9 KVA

==== BUS: 115 F1 L15 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4201 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 25.5 KW 8.2 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 25.5 KW 8.2 KVAR 26.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 120 F1 L31 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4195 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 225.8 KW 74.2 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 72 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 496.8 KW 163.9 KVAR 523.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .7 KVAR .9 KVA

LOAD TO: 121 F1 L63 FEEDER AMPS: 39 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 271.0 KW 89.6 KVAR 285.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 121 F1 L63 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4192 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 62.9 KW 21.3 KVAR

LOAD FROM: 120 F1 L31 FEEDER AMPS: 39 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 270.8 KW 89.4 KVAR 285.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 122 F1 L64 FEEDER AMPS: 14 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 99.2 KW 32.5 KVAR 104.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 125 F1 L67 FEEDER AMPS: 16 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 108.6 KW 35.5 KVAR 114.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 122 F1 L64 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4191 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 99.2 KW 32.5 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 14 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 99.2 KW 32.5 KVAR 104.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 125 F1 L67 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4191 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 62.9 KW 20.3 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 16 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 108.6 KW 35.5 KVAR 114.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 130 F1 L613 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.5 KW 10.2 KVAR 33.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 135 F1 L68 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 14.2 KW 5.1 KVAR 15.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 130 F1 L613 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4190 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 31.5 KW 10.1 KVAR

LOAD FROM: 125 F1 L67 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.5 KW 10.1 KVAR 33.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 135 F1 L68 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4191 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 14.2 KW 5.1 KVAR

LOAD FROM: 125 F1 L67 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 14.2 KW 5.1 KVAR 15.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 200 FDR 2 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 77 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 539.0 KW 177.4 KVAR 567.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 205 FEEDER AMPS: 77 VOLTAGE DROP: 10. %VD: .2
PROJECTED POWER FLOW: 539.0 KW 177.4 KVAR 567.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.6 KVA

==== BUS: 205 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4221 %VD: -1.5
===== PU BUS VOLTAGE: 1.015 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 71.0 KW 22.6 KVAR

LOAD FROM: 200 FDR 2 FEEDER AMPS: 77 VOLTAGE DROP: 10. %VD: .2
PROJECTED POWER FLOW: 538.0 KW 176.1 KVAR 566.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.0 KW 1.3 KVAR 1.6 KVA

LOAD TO: 210 2-3 PRI FEEDER AMPS: 35 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 240.8 KW 79.3 KVAR 253.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 235 F5 F29 FEEDER AMPS: 33 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 226.2 KW 74.2 KVAR 238.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 210 2-3 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4220 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.5 KW 29.8 KVAR

LOAD FROM: 205 FEEDER AMPS: 35 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 240.7 KW 79.2 KVAR 253.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 215 2-4 PRI FEEDER AMPS: 22 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 150.2 KW 49.4 KVAR 158.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 225 2-3 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 215 2-4 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4219 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.5 KW 29.8 KVAR

LOAD FROM: 210 2-3 PRI FEEDER AMPS: 22 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 150.2 KW 49.4 KVAR 158.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 220 2-5 PRI FEEDER AMPS: 9 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 59.7 KW 19.5 KVAR 62.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 230 2-4 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 220 2-5 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4219 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 59.7 KW 19.5 KVAR

LOAD FROM: 215 2-4 PRI FEEDER AMPS: 9 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 59.7 KW 19.5 KVAR 62.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 225 2-3 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 487 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 230 2-4 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 211 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 235 F5 F29 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4218 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 45.2 KW 14.4 KVAR

LOAD FROM: 205 FEEDER AMPS: 33 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 226.1 KW 74.0 KVAR 237.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 236 F2 F211 FEEDER AMPS: 26 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 180.8 KW 59.7 KVAR 190.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

==== BUS: 236 F2 F211 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4216 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.4 KW 29.8 KVAR

LOAD FROM: 235 F5 F29 FEEDER AMPS: 26 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 180.8 KW 59.7 KVAR 190.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 240 F1 F213 FEEDER AMPS: 13 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 90.4 KW 29.8 KVAR 95.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 240 F1 F213 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4216 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.4 KW 29.8 KVAR

LOAD FROM: 236 F2 F211 FEEDER AMPS: 13 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 90.4 KW 29.8 KVAR 95.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 300 FDR 3 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 54 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 374.5 KW 124.4 KVAR 394.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 301 F8 F311 FEEDER AMPS: 54 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 374.5 KW 124.4 KVAR 394.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

==== BUS: 301 F8 F311 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4226 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 192.0 KW 63.0 KVAR

LOAD FROM: 300 FDR 3 FEEDER AMPS: 54 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 374.2 KW 124.0 KVAR 394.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

LOAD TO: 303 F713 FEEDER AMPS: 26 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 182.2 KW 61.0 KVAR 192.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 303 F713 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4225 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES

LOAD FROM: 301 F8 F311 FEEDER AMPS: 26 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 182.2 KW 61.0 KVAR 192.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 305 F8 F311 FEEDER AMPS: 26 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 182.2 KW 61.0 KVAR 192.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 305 F8 F311 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4223 %VD: -1.5
===== PU BUS VOLTAGE: 1.015 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.5 KW 5.2 KVAR

LOAD FROM: 303 F713 FEEDER AMPS: 26 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 182.1 KW 60.9 KVAR 192.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 310 F3 19 FEEDER AMPS: 24 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 166.6 KW 55.7 KVAR 175.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 310 F3 19 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4217 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 166.4 KW 55.5 KVAR

LOAD FROM: 305 F8 F311 FEEDER AMPS: 24 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 166.4 KW 55.5 KVAR 175.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 400 FDR 4 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 60 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 417.0 KW 138.6 KVAR 439.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 401 4-1 PRI FEEDER AMPS: 60 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 417.0 KW 138.6 KVAR 439.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

==== BUS: 401 4-1 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4228 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 77.5 KW 25.8 KVAR

LOAD FROM: 400 FDR 4 FEEDER AMPS: 60 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 416.8 KW 138.3 KVAR 439.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 403 F1 F45 FEEDER AMPS: 49 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 339.3 KW 112.5 KVAR 357.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 403 F1 F45 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4225 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 125.0 KW 41.0 KVAR

LOAD FROM: 401 4-1 PRI FEEDER AMPS: 49 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 339.1 KW 112.3 KVAR 357.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 405 F4 10 FEEDER AMPS: 31 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 214.1 KW 71.3 KVAR 225.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 405 F4 10 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4222 %VD: -1.5
===== PU BUS VOLTAGE: 1.015 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 66.9 KW 22.7 KVAR

LOAD FROM: 403 F1 F45 FEEDER AMPS: 31 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 214.0 KW 71.1 KVAR 225.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 410 F417 UF1 FEEDER AMPS: 21 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 147.1 KW 48.5 KVAR 154.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 410 F417 UF1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4217 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 147.0 KW 48.3 KVAR

LOAD FROM: 405 F4 10 FEEDER AMPS: 21 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 147.0 KW 48.3 KVAR 154.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 415 4-6 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 415 4-6 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 211 %VD: -1.4
===== PU BUS VOLTAGE: 1.014 ANGLE: -3.2 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 500 FDR 5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 38 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 266.0 KW 90.6 KVAR 281.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 505 F4 F5 F6UF FEEDER AMPS: 38 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 266.0 KW 90.6 KVAR 281.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

==== BUS: 505 F4 F5 F6UF DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4226 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES

LOAD FROM: 500 FDR 5 FEEDER AMPS: 38 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 265.8 KW 90.2 KVAR 280.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

LOAD TO: 510 5-1 PRI FEEDER AMPS: 5 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 32.0 KW 10.3 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 512 5-3 PRI FEEDER AMPS: 34 VOLTAGE DROP: 12. %VD: .3
PROJECTED POWER FLOW: 233.8 KW 79.9 KVAR 247.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .8 KVA

==== BUS: 510 5-1 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4226 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 32.0 KW 10.3 KVAR

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 5 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 32.0 KW 10.3 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 512 5-3 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4214 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 14.4 KW 5.1 KVAR

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 34 VOLTAGE DROP: 12. %VD: .3
PROJECTED POWER FLOW: 233.3 KW 79.3 KVAR 246.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .8 KVA

LOAD TO: 514 5-5 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.1 KVAR 5.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 515 F5 L24 FEEDER AMPS: 31 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 213.8 KW 72.1 KVAR 225.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

==== BUS: 514 5-5 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4214 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 2.1 KVAR

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.1 KVAR 5.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 515 F5 L24 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4206 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.2 KW 3.4 KVAR

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 31 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 213.5 KW 71.7 KVAR 225.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .4 KVAR .5 KVA

LOAD TO: 520 5-6 PRI FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.0 KVAR 5.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 525 F5 L31 FEEDER AMPS: 29 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 200.2 KW 66.3 KVAR 210.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 520 5-6 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4206 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 2.0 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 2.0 KVAR 5.5 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 525 F5 L31 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4205 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.2 KW 3.4 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 29 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 200.2 KW 66.2 KVAR 210.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 530 F5 L39 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 1.9 KVAR 5.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 531 F3 L41 FEEDER AMPS: 14 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 98.7 KW 32.1 KVAR 103.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 13 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 88.2 KW 28.8 KVAR 92.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 530 F5 L39 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4205 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 1.9 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 5.1 KW 1.9 KVAR 5.5 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 531 F3 L41 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4204 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 16.3 KW 5.1 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 14 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 98.7 KW 32.1 KVAR 103.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 82.3 KW 27.0 KVAR 86.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 535 F537 L5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4201 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 1.9 KVAR

LOAD FROM: 525 F5 L31 FEEDER AMPS: 13 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 88.1 KW 28.8 KVAR 92.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD FROM: 531 F3 L41 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 82.3 KW 26.9 KVAR 86.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 540 F5 L5 UF1 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 16.3 KW 6.1 KVAR 17.4 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 555 FEEDER AMPS: 21 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 149.0 KW 47.6 KVAR 156.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

==== BUS: 540 F5 L5 UF1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4201 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW 1.0 KVAR

LOAD FROM: 535 F537 L5 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 16.3 KW 6.1 KVAR 17.4 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 545 F5 L56 UF1 FEEDER AMPS: 2 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 12.2 KW 4.1 KVAR 12.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 550 F5 L55 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 2.0 KW 1.0 KVAR 2.3 KVA PF: .89 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 545 F5 L56 UF1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4199 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 12.2 KW 4.1 KVAR

LOAD FROM: 540 F5 L5 UF1 FEEDER AMPS: 2 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 12.2 KW 4.1 KVAR 12.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 547 5-16 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 547 5-16 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 210 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.3 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 550 F5 L55 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4201 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW 1.0 KVAR

LOAD FROM: 540 F5 L5 UF1 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 2.0 KW 1.0 KVAR 2.3 KVA PF: .89 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 555 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4196 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES

LOAD FROM: 535 F537 L5 FEEDER AMPS: 21 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 148.8 KW 47.5 KVAR 156.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 560 RICH SUB FEEDER AMPS: 4 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 26.1 KW 8.6 KVAR 27.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 565 5-17 PRI FEEDER AMPS: 18 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 122.8 KW 38.9 KVAR 128.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 560 RICH SUB DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4192 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES

LOAD FROM: 555 FEEDER AMPS: 4 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 26.1 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 562 RS SEC TRANSF AMPS: 4 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 26.1 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

==== BUS: 562 RS SEC DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13288 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.5 DEGREES

LOAD FROM: 560 RICH SUB TRANSF AMPS: 1 VOLTAGE DROP: 15. %VD: .1
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

LOAD TO: 930 RICH SUB FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 565 5-17 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4192 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 2.0 KVAR

LOAD FROM: 555 FEEDER AMPS: 18 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 122.7 KW 38.8 KVAR 128.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 570 5-18 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.1 KW 3.3 KVAR 8.8 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 575 F5 51 FEEDER AMPS: 16 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 109.5 KW 33.4 KVAR 114.5 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 570 5-18 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4192 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.1 KW 3.3 KVAR

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.1 KW 3.3 KVAR 8.8 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 575 F5 51 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4190 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.0 KW .7 KVAR

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 16 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 109.4 KW 33.4 KVAR 114.4 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 580 F5 L85 FEEDER AMPS: 15 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 107.4 KW 32.7 KVAR 112.3 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 580 F5 L85 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4188 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.1 KW 3.3 KVAR

LOAD FROM: 575 F5 51 FEEDER AMPS: 15 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 107.3 KW 32.7 KVAR 112.2 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 585 F5 L87 UF1 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 24.3 KW 8.1 KVAR 25.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 590 F5 L8911 FEEDER AMPS: 11 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 74.9 KW 21.3 KVAR 77.9 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 585 F5 L87 UF1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4187 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 24.3 KW 8.1 KVAR

LOAD FROM: 580 F5 L85 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 24.3 KW 8.1 KVAR 25.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 590 F5 L8911 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4186 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 41.5 KW 11.1 KVAR

LOAD FROM: 580 F5 L85 FEEDER AMPS: 11 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 74.9 KW 21.2 KVAR 77.8 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 591 5-23 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 593 5-24 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 595 F5 L8 25 FEEDER AMPS: 5 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 33.4 KW 10.1 KVAR 34.9 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 591 5-23 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 209 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.4 DEGREES
**** NO LOAD SPECIFIED ****

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 593 5-24 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 209 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.4 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 595 F5 L8 25 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4181 %VD: -.5
===== PU BUS VOLTAGE: 1.005 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 33.3 KW 10.1 KVAR

LOAD FROM: 590 F5 L8911 FEEDER AMPS: 5 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 33.3 KW 10.1 KVAR 34.8 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 600 O/H BUS DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4232 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 700 FDR 7 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 71 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 493.8 KW 164.2 KVAR 520.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 705 WELL9 POL FEEDER AMPS: 71 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 493.8 KW 164.2 KVAR 520.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 705 WELL9 POL DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4230 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 42.4 KW 14.5 KVAR

LOAD FROM: 700 FDR 7 FEEDER AMPS: 71 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 493.8 KW 164.1 KVAR 520.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD FROM: 707 7-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 709 F9 F73 FEEDER AMPS: 65 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 451.4 KW 149.7 KVAR 475.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

==== BUS: 707 7-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 488 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 709 F9 F73 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4227 %VD: -1.6
===== PU BUS VOLTAGE: 1.016 ANGLE: -3.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 85.7 KW 27.9 KVAR

LOAD FROM: 705 WELL9 POL FEEDER AMPS: 65 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 451.2 KW 149.4 KVAR 475.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

LOAD TO: 710 F7 L11 FEEDER AMPS: 53 VOLTAGE DROP: 11. %VD: .3
PROJECTED POWER FLOW: 365.4 KW 121.5 KVAR 385.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

==== BUS: 710 F7 L11 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4216 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 86.3 KW 28.8 KVAR

LOAD FROM: 709 F9 F73 FEEDER AMPS: 53 VOLTAGE DROP: 11. %VD: .3
PROJECTED POWER FLOW: 364.7 KW 120.5 KVAR 384.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW 1.0 KVAR 1.2 KVA

LOAD TO: 715 F7 L13 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 21.6 KW 7.2 KVAR 22.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 720 F713 FEEDER AMPS: 37 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 256.8 KW 84.5 KVAR 270.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 715 F7 L13 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4216 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 21.6 KW 7.2 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 21.6 KW 7.2 KVAR 22.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 720 F713 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4212 %VD: -1.3
===== PU BUS VOLTAGE: 1.013 ANGLE: -3.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 31.8 KW 10.3 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 37 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 256.7 KW 84.3 KVAR 270.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 725 7-15 PRI FEEDER AMPS: 32 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 224.9 KW 74.0 KVAR 236.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

==== BUS: 725 7-15 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4204 %VD: -1.1
===== PU BUS VOLTAGE: 1.011 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 94.0 KW 30.6 KVAR

LOAD FROM: 720 F713 FEEDER AMPS: 32 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 224.5 KW 73.6 KVAR 236.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

LOAD TO: 730 F7 L43 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 12.3 KW 4.1 KVAR 12.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 735 F7 L54 FEEDER AMPS: 17 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 118.3 KW 38.8 KVAR 124.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 750 F7 L72 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 28.6 KW 9.2 KVAR 30.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 760 7-21 PRI FEEDER AMPS: 7 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 50.9 KW 17.3 KVAR 53.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 750 F7 L72 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4201 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 21.4 KW 7.1 KVAR

LOAD FROM: 745 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 28.5 KW 9.2 KVAR 30.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 755 F7-33 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 7.1 KW 2.0 KVAR 7.4 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 755 F7-33 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4200 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 7.1 KW 2.0 KVAR

LOAD FROM: 750 F7 L72 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 7.1 KW 2.0 KVAR 7.4 KVA PF: .96 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 760 7-21 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4199 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 12.2 KW 4.1 KVAR

LOAD FROM: 745 FEEDER AMPS: 7 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 50.9 KW 17.3 KVAR 53.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 765 7-22 PRI FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 38.7 KW 13.2 KVAR 40.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 765 7-22 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4198 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 21.4 KW 7.1 KVAR

LOAD FROM: 760 7-21 PRI FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 38.7 KW 13.2 KVAR 40.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 770 7-23 PRI FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 17.3 KW 6.1 KVAR 18.4 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 770 7-23 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4198 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.1 KW 2.0 KVAR

LOAD FROM: 765 7-22 PRI FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 17.3 KW 6.1 KVAR 18.4 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 775 7-24 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 12.2 KW 4.1 KVAR 12.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 775 7-24 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4198 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 12.2 KW 4.1 KVAR

LOAD FROM: 770 7-23 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 12.2 KW 4.1 KVAR 12.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 800 FDR 8 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 59 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 410.7 KW 139.1 KVAR 433.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 817 F8 22 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4195 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 44.7 KW 15.3 KVAR

LOAD FROM: 810 F8 L23 FEEDER AMPS: 43 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 298.8 KW 99.5 KVAR 314.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD TO: 820 F8 30 UF1 FEEDER AMPS: 37 VOLTAGE DROP: 9. %VD: .2
PROJECTED POWER FLOW: 254.0 KW 84.3 KVAR 267.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .7 KVA

==== BUS: 820 F8 30 UF1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4186 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 117.5 KW 38.5 KVAR

LOAD FROM: 817 F8 22 FEEDER AMPS: 37 VOLTAGE DROP: 9. %VD: .2
PROJECTED POWER FLOW: 253.6 KW 83.7 KVAR 267.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .7 KVA

LOAD TO: 825 8-22 PRI FEEDER AMPS: 20 VOLTAGE DROP: 7. %VD: .2
PROJECTED POWER FLOW: 136.2 KW 45.2 KVAR 143.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 825 8-22 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4179 %VD: -.5
===== PU BUS VOLTAGE: 1.005 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 136.0 KW 45.0 KVAR

LOAD FROM: 820 F8 30 UF1 FEEDER AMPS: 20 VOLTAGE DROP: 7. %VD: .2
PROJECTED POWER FLOW: 136.0 KW 45.0 KVAR 143.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 900 FDR 9 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4231 %VD: -1.7
===== PU BUS VOLTAGE: 1.017 ANGLE: -3.1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 65 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 451.5 KW 156.2 KVAR 477.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 905 STEP SEC TRANSF AMPS: 65 VOLTAGE DROP: 29. %VD: .7
PROJECTED POWER FLOW: 451.5 KW 156.2 KVAR 477.8 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: 1.1 KW 6.7 KVAR 6.8 KVA

==== BUS: 905 STEP SEC DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13334 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.8 DEGREES

LOAD FROM: 900 FDR 9 TRANSF AMPS: 21 VOLTAGE DROP: 91. %VD: .7
PROJECTED POWER FLOW: 450.4 KW 149.5 KVAR 474.5 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: 1.1 KW 6.7 KVAR 6.8 KVA

LOAD TO: 910 F 96 FEEDER AMPS: 21 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 450.4 KW 149.5 KVAR 474.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 910 F 96 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13332 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 18.2 KW 6.0 KVAR

LOAD FROM: 905 STEP SEC FEEDER AMPS: 21 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 450.3 KW 149.4 KVAR 474.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 915 F910 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 432.1 KW 143.4 KVAR 455.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 915 F910 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13328 %VD: -1.0
===== PU BUS VOLTAGE: 1.010 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 60.8 KW 20.0 KVAR

LOAD FROM: 910 F 96 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 432.0 KW 143.3 KVAR 455.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 920 F940 FEEDER AMPS: 17 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 371.3 KW 123.4 KVAR 391.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 920 F940 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13312 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 10.5 KW 3.4 KVAR

LOAD FROM: 915 F910 FEEDER AMPS: 17 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 370.9 KW 122.9 KVAR 390.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .5 KVAR .6 KVA

LOAD TO: 945 F949 L1 FEEDER AMPS: 16 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 360.5 KW 119.5 KVAR 379.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 925 () DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13286 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.5 DEGREES

LOAD FROM: 930 RICH SUB FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 930 RICH SUB DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13288 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.5 DEGREES

LOAD FROM: 562 RS SEC FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 925 () FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 935 9-8 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13285 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 10.4 KW 3.4 KVAR

LOAD FROM: 925 () FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 26.0 KW 8.6 KVAR 27.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 940 9-9 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 15.6 KW 5.1 KVAR 16.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 940 9-9 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13280 %VD: -.6
===== PU BUS VOLTAGE: 1.006 ANGLE: -3.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 15.6 KW 5.1 KVAR

LOAD FROM: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 15.6 KW 5.1 KVAR 16.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 945 F949 L1 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13309 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.4 KW 1.8 KVAR

LOAD FROM: 920 F940 FEEDER AMPS: 16 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 360.4 KW 119.4 KVAR 379.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 950 9-12 PRI FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 8.4 KW 2.7 KVAR 8.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 960 9-13 PRI FEEDER AMPS: 16 VOLTAGE DROP: 18. %VD: .1
PROJECTED POWER FLOW: 346.6 KW 114.8 KVAR 365.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .5 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 950 9-12 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13308 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.2 KW 1.4 KVAR

LOAD FROM: 945 F949 L1 FEEDER AMPS: VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 8.4 KW 2.7 KVAR 8.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 955 9-11 PRI FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 4.2 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 955 9-11 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13308 %VD: -.8
===== PU BUS VOLTAGE: 1.008 ANGLE: -3.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.2 KW 1.4 KVAR

LOAD FROM: 950 9-12 PRI FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 4.2 KW 1.4 KVAR 4.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 960 9-13 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13291 %VD: -.7
===== PU BUS VOLTAGE: 1.007 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 18.1 KW 5.9 KVAR

LOAD FROM: 945 F949 L1 FEEDER AMPS: 16 VOLTAGE DROP: 18. %VD: .1
PROJECTED POWER FLOW: 346.2 KW 114.6 KVAR 364.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .5 KVA

LOAD TO: 963 9-14 PRI FEEDER AMPS: 15 VOLTAGE DROP: 60. %VD: .5
PROJECTED POWER FLOW: 328.1 KW 108.7 KVAR 345.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.6 KVA

==== BUS: 963 9-14 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13231 %VD: -.2
===== PU BUS VOLTAGE: 1.002 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 17.9 KW 5.9 KVAR

LOAD FROM: 960 9-13 PRI FEEDER AMPS: 15 VOLTAGE DROP: 60. %VD: .5
PROJECTED POWER FLOW: 326.7 KW 108.0 KVAR 344.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.6 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 966 9-15 PRI FEEDER AMPS: 14 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 308.8 KW 102.1 KVAR 325.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .2 KVAR .4 KVA

==== BUS: 966 9-15 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13215 %VD: -.1
===== PU BUS VOLTAGE: 1.001 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 2.1 KW .7 KVAR

LOAD FROM: 963 9-14 PRI FEEDER AMPS: 14 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 308.4 KW 102.0 KVAR 324.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .2 KVAR .4 KVA

LOAD TO: 969 SW UP FEEDER AMPS: 14 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 306.4 KW 101.3 KVAR 322.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 969 SW UP DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13210 %VD: -.1
===== PU BUS VOLTAGE: 1.001 ANGLE: -3.9 DEGREES

LOAD FROM: 966 9-15 PRI FEEDER AMPS: 14 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 306.3 KW 101.2 KVAR 322.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 972 SW DOWN FEEDER AMPS: 14 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 306.3 KW 101.2 KVAR 322.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 972 SW DOWN DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13210 %VD: -.1
===== PU BUS VOLTAGE: 1.001 ANGLE: -3.9 DEGREES

LOAD FROM: 969 SW UP FEEDER AMPS: 14 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 306.3 KW 101.2 KVAR 322.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 975 9-16 PRI FEEDER AMPS: 14 VOLTAGE DROP: 62. %VD: .5
PROJECTED POWER FLOW: 306.3 KW 101.2 KVAR 322.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.5 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 975 9-16 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13148 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.9 DEGREES

LOAD FROM: 972 SW DOWN FEEDER AMPS: 14 VOLTAGE DROP: 62. %VD: .5
PROJECTED POWER FLOW: 304.9 KW 100.6 KVAR 321.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.4 KW .7 KVAR 1.5 KVA

LOAD TO: 977 9-19 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 16.3 KW 5.4 KVAR 17.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 980 FEEDER AMPS: 13 VOLTAGE DROP: 25. %VD: .2
PROJECTED POWER FLOW: 288.6 KW 95.2 KVAR 303.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .6 KVA

==== BUS: 977 9-19 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13144 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 16.3 KW 5.4 KVAR

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 16.3 KW 5.4 KVAR 17.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 980 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13123 %VD: .6
===== PU BUS VOLTAGE: .994 ANGLE: -3.9 DEGREES

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 13 VOLTAGE DROP: 25. %VD: .2
PROJECTED POWER FLOW: 288.0 KW 95.0 KVAR 303.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .6 KVA

LOAD TO: 982 9-20 PRI FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 6.1 KW 2.0 KVAR 6.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 983 9-25 PRI FEEDER AMPS: 13 VOLTAGE DROP: 41. %VD: .3
PROJECTED POWER FLOW: 281.9 KW 93.0 KVAR 296.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .8 KW .4 KVAR .9 KVA

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 982 9-20 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13123 %VD: .6
===== PU BUS VOLTAGE: .994 ANGLE: -3.9 DEGREES
PROJECTED SPECIAL BUS LOAD: 6.1 KW 2.0 KVAR

LOAD FROM: 980 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 6.1 KW 2.0 KVAR 6.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 983 9-25 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13082 %VD: .9
===== PU BUS VOLTAGE: .991 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 159.7 KW 52.5 KVAR

LOAD FROM: 980 FEEDER AMPS: 13 VOLTAGE DROP: 41. %VD: .3
PROJECTED POWER FLOW: 281.1 KW 92.5 KVAR 295.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .8 KW .4 KVAR .9 KVA

LOAD TO: 984 9-25 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 985 9-34 PRI FEEDER AMPS: 6 VOLTAGE DROP: 6. %VD: .0
PROJECTED POWER FLOW: 121.4 KW 40.0 KVAR 127.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 984 9-25 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 206 %VD: .9
===== PU BUS VOLTAGE: .991 ANGLE: -4.0 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 985 9-34 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13076 %VD: .9
===== PU BUS VOLTAGE: .991 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 10.5 KW 3.4 KVAR

LOAD FROM: 983 9-25 PRI FEEDER AMPS: 6 VOLTAGE DROP: 6. %VD: .0
PROJECTED POWER FLOW: 121.3 KW 40.0 KVAR 127.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 987 FEEDER AMPS: 5 VOLTAGE DROP: 17. %VD: .1
PROJECTED POWER FLOW: 110.8 KW 36.6 KVAR 116.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

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FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 987 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13059 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -4.0 DEGREES

LOAD FROM: 985 9-34 PRI FEEDER AMPS: 5 VOLTAGE DROP: 17. %VD: .1
PROJECTED POWER FLOW: 110.7 KW 36.5 KVAR 116.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD TO: 990 9-26 PRI FEEDER AMPS: 2 VOLTAGE DROP: 11. %VD: .1
PROJECTED POWER FLOW: 45.2 KW 14.8 KVAR 47.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 992 FEEDER AMPS: 3 VOLTAGE DROP: 43. %VD: .3
PROJECTED POWER FLOW: 65.5 KW 21.6 KVAR 69.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

==== BUS: 990 9-26 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13048 %VD: 1.2
===== PU BUS VOLTAGE: .988 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 45.1 KW 14.8 KVAR

LOAD FROM: 987 FEEDER AMPS: 2 VOLTAGE DROP: 11. %VD: .1
PROJECTED POWER FLOW: 45.1 KW 14.8 KVAR 47.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 992 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13016 %VD: 1.4
===== PU BUS VOLTAGE: .986 ANGLE: -4.0 DEGREES

LOAD FROM: 987 FEEDER AMPS: 3 VOLTAGE DROP: 43. %VD: .3
PROJECTED POWER FLOW: 65.3 KW 21.6 KVAR 68.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 995 9-30 PRI FEEDER AMPS: 2 VOLTAGE DROP: 30. %VD: .2
PROJECTED POWER FLOW: 44.9 KW 14.7 KVAR 47.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 997 9-32 PRI FEEDER AMPS: 1 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 20.4 KW 6.8 KVAR 21.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 995 9-30 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 12985 %VD: 1.6
===== PU BUS VOLTAGE: .984 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 44.8 KW 14.7 KVAR

LOAD FROM: 992 FEEDER AMPS: 2 VOLTAGE DROP: 30. %VD: .2
PROJECTED POWER FLOW: 44.8 KW 14.7 KVAR 47.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 997 9-32 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13013 %VD: 1.4
===== PU BUS VOLTAGE: .986 ANGLE: -4.0 DEGREES
PROJECTED SPECIAL BUS LOAD: 20.4 KW 6.8 KVAR

LOAD FROM: 992 FEEDER AMPS: 1 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 20.4 KW 6.8 KVAR 21.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.023	15	G1 STEP-UP	2400.00	1.023
20	GEN G2	2400.00	1.017	25	G2 STEP-UP	2400.00	1.017
30	GEN G3	2400.00	1.017	35	G3 STEP-UP	2400.00	1.017
40	GEN G4	4160.00	1.017	50	GEN G5	4160.00	1.017
60	SWGR S	4160.00	1.017	62	SS-1 SEC	480.00	1.017
64	MCC 4&5	480.00	1.017	66	SM1A BLUE	4160.00	1.017
68	BLUE SSS	480.00	1.017	70	SWGR N	4160.00	1.017
80	UTILITY	24900.00	1.000	85	T1 SEC	4160.00	1.017
90	SWGR O	4160.00	1.017	100	FDR 1	4160.00	1.017
105	F1F12 14	4160.00	1.011	110	F1 L14	4160.00	1.010
115	F1 L15	4160.00	1.010	120	F1 L31	4160.00	1.009
121	F1 L63	4160.00	1.008	122	F1 L64	4160.00	1.007
125	F1 L67	4160.00	1.007	130	F1 L613	4160.00	1.007
135	F1 L68	4160.00	1.007	200	FDR 2	4160.00	1.017
205		4160.00	1.015	210	2-3 PRI	4160.00	1.014
215	2-4 PRI	4160.00	1.014	220	2-5 PRI	4160.00	1.014
225	2-3 SEC	480.00	1.014	230	2-4 SEC	208.00	1.014
235	F5 F29	4160.00	1.014	236	F2 F211	4160.00	1.014
240	F1 F213	4160.00	1.013	300	FDR 3	4160.00	1.017
301	F8 F311	4160.00	1.016	303	F713	4160.00	1.016
305	F8 F311	4160.00	1.015	310	F3 19	4160.00	1.014
400	FDR 4	4160.00	1.017	401	4-1 PRI	4160.00	1.016
403	F1 F45	4160.00	1.016	405	F4 10	4160.00	1.015
410	F417 UF1	4160.00	1.014	415	4-6 SEC	208.00	1.014
500	FDR 5	4160.00	1.017	505	F4 F5 F6UF	4160.00	1.016
510	5-1 PRI	4160.00	1.016	512	5-3 PRI	4160.00	1.013
514	5-5 PRI	4160.00	1.013	515	F5 L24	4160.00	1.011
520	5-6 PRI	4160.00	1.011	525	F5 L31	4160.00	1.011
530	F5 L39	4160.00	1.011	531	F3 L41	4160.00	1.010
535	F537 L5	4160.00	1.010	540	F5 L5 UF1	4160.00	1.010
545	F5 L56 UF1	4160.00	1.009	547	5-16 SEC	208.00	1.009
550	F5 L55	4160.00	1.010	555		4160.00	1.009
560	RICH SUB	4160.00	1.008	562	RS SEC	13200.00	1.007
565	5-17 PRI	4160.00	1.008	570	5-18 PRI	4160.00	1.008
575	F5 51	4160.00	1.007	580	F5 L85	4160.00	1.007
585	F5 L87 UF1	4160.00	1.007	590	F5 L8911	4160.00	1.006
591	5-23 SEC	208.00	1.006	593	5-24 SEC	208.00	1.006
595	F5 L8 25	4160.00	1.005	600	O/H BUS	4160.00	1.017
700	FDR 7	4160.00	1.017	705	WELL9 POL	4160.00	1.017
707	7-1 SEC	480.00	1.017	709	F9 F73	4160.00	1.016

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
710	F7 L11	4160.00	1.013	715	F7 L13	4160.00	1.013
720	F713	4160.00	1.013	725	7-15 PRI	4160.00	1.011
730	F7 L43	4160.00	1.011	735	F7 L54	4160.00	1.010
740	7-17 PRI	4160.00	1.010	745		4160.00	1.010
750	F7 L72	4160.00	1.010	755	F7-33	4160.00	1.010
760	7-21 PRI	4160.00	1.009	765	7-22 PRI	4160.00	1.009
770	7-23 PRI	4160.00	1.009	775	7-24 PRI	4160.00	1.009
800	FDR 8	4160.00	1.017	805	F8 L11	4160.00	1.012
810	F8 L23	4160.00	1.009	815	F8 L25	4160.00	1.009
817	F8 22	4160.00	1.008	820	F8 30 UF1	4160.00	1.006
825	8-22 PRI	4160.00	1.005	900	FDR 9	4160.00	1.017
905	STEP SEC	13200.00	1.010	910	F 96	13200.00	1.010
915	F910	13200.00	1.010	920	F940	13200.00	1.008
925	()	13200.00	1.007	930	RICH SUB	13200.00	1.007
935	9-8 PRI	13200.00	1.006	940	9-9 PRI	13200.00	1.006
945	F949 L1	13200.00	1.008	950	9-12 PRI	13200.00	1.008
955	9-11 PRI	13200.00	1.008	960	9-13 PRI	13200.00	1.007
963	9-14 PRI	13200.00	1.002	966	9-15 PRI	13200.00	1.001
969	SW UP	13200.00	1.001	972	SW DOWN	13200.00	1.001
975	9-16 PRI	13200.00	.996	977	9-19 PRI	13200.00	.996
980		13200.00	.994	982	9-20 PRI	13200.00	.994
983	9-25 PRI	13200.00	.991	984	9-25 SEC	208.00	.991
985	9-34 PRI	13200.00	.991	987		13200.00	.989
990	9-26 PRI	13200.00	.988	992		13200.00	.986
995	9-30 PRI	13200.00	.984	997	9-32 PRI	13200.00	.986

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATINGX
10	GEN G1	15	G1 STEP-UP	FDR	.03	235.10	1000.00	50.56
15	G1 STEP-UP	10	GEN G1	FDR	.03	235.10	999.75	50.56
15	G1 STEP-UP	60	SWGR S	TX2	.58	235.10	999.75	UNKNOW
20	GEN G2	25	G2 STEP-UP	FDR	.00	.00	.00	.00
25	G2 STEP-UP	20	GEN G2	FDR	.00	.00	.00	.00
25	G2 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
30	GEN G3	35	G3 STEP-UP	FDR	.00	.00	.00	.00
35	G3 STEP-UP	30	GEN G3	FDR	.00	.00	.00	.00
35	G3 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
60	SWGR S	15	G1 STEP-UP	TX2	.58	135.64	994.05	UNKNOW
60	SWGR S	25	G2 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	35	G3 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	62	SS-1 SEC	TX2	.00	.02	.17	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.03	.25	.01
60	SWGR S	70	SWGR N	FDR	.00	188.71	1382.99	40.58
60	SWGR S	100	FDR 1	FDR	.02	80.08	586.87	34.82
60	SWGR S	200	FDR 2	FDR	.02	77.44	567.52	33.67
60	SWGR S	300	FDR 3	FDR	.01	53.85	394.65	23.41
60	SWGR S	400	FDR 4	FDR	.01	59.97	439.51	26.07
60	SWGR S	500	FDR 5	FDR	.01	38.35	281.04	16.67
62	SS-1 SEC	60	SWGR S	TX2	.00	.20	.17	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.20	.17	.04
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.20	.17	.04
64	MCC 4&5	68	BLUE SSS	FDR	.00	.30	.25	.06
64	MCC 4&5	90	SWGR O	TX2	.00	.49	.42	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.03	.25	.01
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.03	.25	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.30	.25	.06
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.30	.25	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	188.71	1383.02	40.58
70	SWGR N	90	SWGR O	FDR	.00	188.71	1383.02	51.00
80	UTILITY	85	T1 SEC	TX2	-1.73	67.03	2890.77	UNKNOW
85	T1 SEC	80	UTILITY	TX2	-1.73	381.15	2793.82	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.01	381.15	2793.82	103.01
90	SWGR O	64	MCC 4&5	TX2	.00	.06	.42	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	188.71	1383.09	51.00
90	SWGR O	85	T1 SEC	FDR	.01	381.15	2793.56	103.01
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.02	71.02	520.52	30.88
90	SWGR O	800	FDR 8	FDR	.01	59.17	433.70	25.73
90	SWGR O	900	FDR 9	FDR	.02	65.19	477.84	28.35
100	FDR 1	60	SWGR S	FDR	.02	80.08	586.77	34.82
100	FDR 1	105	F1F12 14	FDR	.62	80.08	586.77	22.43
105	F1F12 14	100	FDR 1	FDR	.62	80.08	583.21	22.43
105	F1F12 14	110	F1 L14	FDR	.08	78.77	573.67	22.06
110	F1 L14	105	F1F12 14	FDR	.08	78.77	573.21	22.06
110	F1 L14	115	F1 L15	FDR	.01	3.68	26.77	1.03

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATINGX
110	F1 L14	120	F1 L31	FDR	.15	71.99	523.86	20.16
115	F1 L15	110	F1 L14	FDR	.01	3.68	26.77	1.03
120	F1 L31	110	F1 L14	FDR	.15	71.99	523.10	20.16
120	F1 L31	121	F1 L63	FDR	.09	39.28	285.41	11.00
121	F1 L63	120	F1 L31	FDR	.09	39.28	285.16	11.00
121	F1 L63	122	F1 L64	FDR	.01	14.38	104.43	4.03
121	F1 L63	125	F1 L67	FDR	.02	15.74	114.27	4.41
122	F1 L64	121	F1 L63	FDR	.01	14.38	104.41	4.03
125	F1 L67	121	F1 L63	FDR	.02	15.74	114.25	4.41
125	F1 L67	130	F1 L613	FDR	.02	4.55	33.05	1.28
125	F1 L67	135	F1 L68	FDR	.00	2.08	15.09	.58
130	F1 L613	125	F1 L67	FDR	.02	4.55	33.05	1.28
135	F1 L68	125	F1 L67	FDR	.00	2.08	15.09	.58
200	FDR 2	60	SWGR S	FDR	.02	77.44	567.42	33.67
200	FDR 2	205		FDR	.24	77.44	567.42	21.69
205		200	FDR 2	FDR	.24	77.44	566.09	21.69
205		210	2-3 PRI	FDR	.03	34.68	253.50	9.71
205		235	F5 F29	FDR	.07	32.56	238.05	9.12
210	2-3 PRI	205		FDR	.03	34.68	253.43	9.71
210	2-3 PRI	215	2-4 PRI	FDR	.01	21.63	158.11	6.06
210	2-3 PRI	225	2-3 SEC	TX2	.00	.00	.00	UNKNOW
215	2-4 PRI	210	2-3 PRI	FDR	.01	21.63	158.10	6.06
215	2-4 PRI	220	2-5 PRI	FDR	.01	8.59	62.78	2.41
215	2-4 PRI	230	2-4 SEC	TX2	.00	.00	.00	UNKNOW
220	2-5 PRI	215	2-4 PRI	FDR	.01	8.59	62.77	2.41
225	2-3 SEC	210	2-3 PRI	TX2	.00	.00	.00	UNKNOW
230	2-4 SEC	215	2-4 PRI	TX2	.00	.00	.00	UNKNOW
235	F5 F29	205		FDR	.07	32.56	237.89	9.12
235	F5 F29	236	F2 F211	FDR	.03	26.07	190.42	7.30
236	F2 F211	235	F5 F29	FDR	.03	26.07	190.36	7.30
236	F2 F211	240	F1 F213	FDR	.02	13.03	95.17	3.65
240	F1 F213	236	F2 F211	FDR	.02	13.03	95.16	3.65
300	FDR 3	60	SWGR S	FDR	.01	53.85	394.60	23.41
300	FDR 3	301	F8 F311	FDR	.11	53.85	394.60	15.08
301	F8 F311	300	FDR 3	FDR	.11	53.85	394.17	15.08
301	F8 F311	303	F713	FDR	.03	26.25	192.15	7.35
303	F713	301	F8 F311	FDR	.03	26.25	192.10	7.35
303	F713	305	F8 F311	FDR	.05	26.25	192.10	7.35
305	F8 F311	303	F713	FDR	.05	26.25	191.99	7.35
305	F8 F311	310	F3 19	FDR	.15	24.02	175.70	6.73

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
310	F3 19	305	F8 F311	FDR	.15	24.02	175.45	6.73
400	FDR 4	60	SWGR S	FDR	.01	59.97	439.44	26.07
400	FDR 4	401	4-1 PRI	FDR	.08	59.97	439.44	16.80
401	4-1 PRI	400	FDR 4	FDR	.08	59.97	439.11	16.80
401	4-1 PRI	403	F1 F45	FDR	.06	48.82	357.47	13.67
403	F1 F45	401	4-1 PRI	FDR	.06	48.82	357.25	13.67
403	F1 F45	405	F4 10	FDR	.08	30.84	225.70	8.64
405	F4 10	403	F1 F45	FDR	.08	30.84	225.52	8.64
405	F4 10	410	F417 UF1	FDR	.11	21.18	154.85	5.93
410	F417 UF1	405	F4 10	FDR	.11	21.18	154.69	5.93
410	F417 UF1	415	4-6 SEC	TX2	.00	.00	.00	UNKNOW
415	4-6 SEC	410	F417 UF1	TX2	.00	.00	.00	UNKNOW
500	FDR 5	60	SWGR S	FDR	.01	38.35	281.02	16.67
500	FDR 5	505	F4 F5 F6UF	FDR	.12	38.35	281.02	10.74
505	F4 F5 F6UF	500	FDR 5	FDR	.12	38.35	280.68	10.74
505	F4 F5 F6UF	510	5-1 PRI	FDR	.01	4.59	33.61	1.29
505	F4 F5 F6UF	512	5-3 PRI	FDR	.28	33.76	247.07	9.46
510	5-1 PRI	505	F4 F5 F6UF	FDR	.01	4.59	33.61	1.29
512	5-3 PRI	505	F4 F5 F6UF	FDR	.28	33.76	246.39	9.46
512	5-3 PRI	514	5-5 PRI	FDR	.00	.76	5.53	.21
512	5-3 PRI	515	F5 L24	FDR	.19	30.91	225.62	8.66
514	5-5 PRI	512	5-3 PRI	FDR	.00	.76	5.53	.21
515	F5 L24	512	5-3 PRI	FDR	.19	30.91	225.20	8.66
515	F5 L24	520	5-6 PRI	FDR	.01	.75	5.49	.72
515	F5 L24	525	F5 L31	FDR	.03	28.95	210.89	8.11
520	5-6 PRI	515	F5 L24	FDR	.01	.75	5.49	.72
525	F5 L31	515	F5 L24	FDR	.03	28.95	210.83	8.11
525	F5 L31	530	F5 L39	FDR	.01	.75	5.46	.21
525	F5 L31	531	F3 L41	FDR	.04	14.25	103.78	3.99
525	F5 L31	535	F537 L5	FDR	.09	12.74	92.78	3.57
530	F5 L39	525	F5 L31	FDR	.01	.75	5.46	.21
531	F3 L41	525	F5 L31	FDR	.04	14.25	103.75	3.99
531	F3 L41	535	F537 L5	FDR	.05	11.90	86.63	3.33
535	F537 L5	525	F5 L31	FDR	.09	12.74	92.69	3.57
535	F537 L5	531	F3 L41	FDR	.05	11.90	86.59	3.33
535	F537 L5	540	F5 L5 UF1	FDR	.00	2.39	17.42	.67
535	F537 L5	555	FDR	FDR	.12	21.50	156.43	7.79
540	F5 L5 UF1	535	F537 L5	FDR	.00	2.39	17.42	.67
540	F5 L5 UF1	545	F5 L56 UF1	FDR	.05	1.77	12.89	.96
540	F5 L5 UF1	550	F5 L55	FDR	.00	.31	2.28	.09

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
545	F5 L56 UF1	540	F5 L5 UF1	FDR	.05	1.77	12.89	.96
545	F5 L56 UF1	547	5-16 SEC	TX2	.00	.00	.00	UNKNOW
547	5-16 SEC	545	F5 L56 UF1	TX2	.00	.00	.00	UNKNOW
550	F5 L55	540	F5 L5 UF1	FDR	.00	.31	2.28	.09
555		535	F537 L5	FDR	.12	21.50	156.24	7.79
555		560	RICH SUB	FDR	.09	3.78	27.47	1.37
555		565	5-17 PRI	FDR	.10	17.72	128.77	6.42
560	RICH SUB	555		FDR	.09	3.78	27.44	1.37
560	RICH SUB	562	RS SEC	TX2	.12	3.78	27.44	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	1.19	27.41	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	1.19	27.41	.85
565	5-17 PRI	555		FDR	.10	17.72	128.64	6.42
565	5-17 PRI	570	5-18 PRI	FDR	.00	1.21	8.78	.44
565	5-17 PRI	575	F5 51	FDR	.03	15.76	114.46	5.71
570	5-18 PRI	565	5-17 PRI	FDR	.00	1.21	8.78	.44
575	F5 51	565	5-17 PRI	FDR	.03	15.76	114.42	5.71
575	F5 51	580	F5 L85	FDR	.07	15.47	112.28	5.61
580	F5 L85	575	F5 51	FDR	.07	15.47	112.21	5.61
580	F5 L85	585	F5 L87 UF1	FDR	.01	3.53	25.63	1.28
580	F5 L85	590	F5 L8911	FDR	.05	10.74	77.87	7.67
585	F5 L87 UF1	580	F5 L85	FDR	.01	3.53	25.63	1.28
590	F5 L8911	580	F5 L85	FDR	.05	10.74	77.83	7.67
590	F5 L8911	591	5-23 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	593	5-24 SEC	TX2	.00	.00	.00	UNKNOW
590	F5 L8911	595	F5 L8 25	FDR	.11	4.81	34.87	3.44
591	5-23 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
593	5-24 SEC	590	F5 L8911	TX2	.00	.00	.00	UNKNOW
595	F5 L8 25	590	F5 L8911	FDR	.11	4.81	34.83	3.44
600	O/H BUS	90	SWGR 0	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR 0	FDR	.02	71.02	520.43	30.88
700	FDR 7	705	WELL9 POL	FDR	.02	71.02	520.43	19.89
705	WELL9 POL	700	FDR 7	FDR	.02	71.02	520.34	19.89
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.07	64.90	475.55	18.18
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.07	64.90	475.23	18.18
709	F9 F73	710	F7 L11	FDR	.27	52.60	385.10	14.73
710	F7 L11	709	F9 F73	FDR	.27	52.60	384.08	14.73
710	F7 L11	715	F7 L13	FDR	.01	3.11	22.74	.87
710	F7 L11	720	F713	FDR	.09	37.03	270.40	10.37

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
715	F7 L13	710	F7 L11	FDR	.01	3.11	22.73	.87
720	F713	710	F7 L11	FDR	.09	37.03	270.14	10.37
720	F713	725	7-15 PRI	FDR	.20	32.45	236.75	9.09
725	7-15 PRI	720	F713	FDR	.20	32.45	236.28	9.09
725	7-15 PRI	730	F7 L43	FDR	.01	1.77	12.92	.50
725	7-15 PRI	735	F7 L54	FDR	.03	17.10	124.54	4.79
730	F7 L43	725	7-15 PRI	FDR	.01	1.77	12.92	.50
735	F7 L54	725	7-15 PRI	FDR	.03	17.10	124.51	4.79
735	F7 L54	740	7-17 PRI	FDR	.01	2.48	18.08	.70
735	F7 L54	745		FDR	.04	11.52	83.84	3.23
740	7-17 PRI	735	F7 L54	FDR	.01	2.48	18.08	.70
745		735	F7 L54	FDR	.04	11.52	83.81	3.23
745		750	F7 L72	FDR	.01	4.12	29.99	1.15
745		760	7-21 PRI	FDR	.05	7.40	53.82	2.07
750	F7 L72	745		FDR	.01	4.12	29.99	1.15
750	F7 L72	755	F7-33	FDR	.00	1.02	7.42	.29
755	F7-33	750	F7 L72	FDR	.00	1.02	7.42	.29
760	7-21 PRI	745		FDR	.05	7.40	53.79	2.07
760	7-21 PRI	765	7-22 PRI	FDR	.02	5.62	40.91	1.58
765	7-22 PRI	760	7-21 PRI	FDR	.02	5.62	40.90	1.58
765	7-22 PRI	770	7-23 PRI	FDR	.01	2.52	18.36	.71
770	7-23 PRI	765	7-22 PRI	FDR	.01	2.52	18.36	.71
770	7-23 PRI	775	7-24 PRI	FDR	.01	1.77	12.88	.50
775	7-24 PRI	770	7-23 PRI	FDR	.01	1.77	12.88	.50
800	FDR 8	90	SWGR 0	FDR	.01	59.17	433.64	25.73
800	FDR 8	805	F8 L11	FDR	.55	59.17	433.64	16.58
805	F8 L11	800	FDR 8	FDR	.55	59.17	431.30	16.58
805	F8 L11	810	F8 L23	FDR	.28	54.73	398.94	15.33
810	F8 L23	805	F8 L11	FDR	.28	54.73	397.83	15.33
810	F8 L23	815	F8 L25	FDR	.00	.63	4.59	.18
810	F8 L23	817	F8 22	FDR	.04	43.34	315.05	12.14
815	F8 L25	810	F8 L23	FDR	.00	.63	4.59	.18
817	F8 22	810	F8 L23	FDR	.04	43.34	314.91	12.14
817	F8 22	820	F8 30 UF1	FDR	.21	36.84	267.65	10.32
820	F8 30 UF1	817	F8 22	FDR	.21	36.84	267.10	10.32
820	F8 30 UF1	825	8-22 PRI	FDR	.17	19.79	143.50	5.54
825	8-22 PRI	820	F8 30 UF1	FDR	.17	19.79	143.25	5.54
900	FDR 9	90	SWGR 0	FDR	.02	65.19	477.76	28.35
900	FDR 9	905	STEP SEC	TX2	.69	65.19	477.76	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.69	20.55	474.53	UNKNOW

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
905	STEP SEC	910	F 96	FDR	.02	20.55	474.53	5.76
910	F 96	905	STEP SEC	FDR	.02	20.55	474.44	5.76
910	F 96	915	F910	FDR	.03	19.72	455.32	5.52
915	F910	910	F 96	FDR	.03	19.72	455.20	5.52
915	F910	920	F940	FDR	.12	16.95	391.23	4.75
920	F940	915	F910	FDR	.12	16.95	390.75	4.75
920	F940	945	F949 L1	FDR	.02	16.47	379.75	4.61
925	()	930	RICH SUB	FDR	.01	1.19	27.41	.85
925	()	935	9-8 PRI	FDR	.01	1.19	27.41	1.13
930	RICH SUB	562	RS SEC	FDR	.00	1.19	27.41	.85
930	RICH SUB	925	()	FDR	.01	1.19	27.41	.85
935	9-8 PRI	925	()	FDR	.01	1.19	27.41	1.13
935	9-8 PRI	940	9-9 PRI	FDR	.03	.71	16.45	.68
940	9-9 PRI	935	9-8 PRI	FDR	.03	.71	16.44	.68
945	F949 L1	920	F940	FDR	.02	16.47	379.67	4.61
945	F949 L1	950	9-12 PRI	FDR	.01	.38	8.80	.36
945	F949 L1	960	9-13 PRI	FDR	.14	15.84	365.15	8.61
950	9-12 PRI	945	F949 L1	FDR	.01	.38	8.79	.36
950	9-12 PRI	955	9-11 PRI	FDR	.00	.19	4.40	.18
955	9-11 PRI	950	9-12 PRI	FDR	.00	.19	4.40	.18
960	9-13 PRI	945	F949 L1	FDR	.14	15.84	364.64	8.61
960	9-13 PRI	963	9-14 PRI	FDR	.45	15.01	345.64	8.16
963	9-14 PRI	960	9-13 PRI	FDR	.45	15.01	344.08	8.16
963	9-14 PRI	966	9-15 PRI	FDR	.12	14.19	325.24	7.71
966	9-15 PRI	963	9-14 PRI	FDR	.12	14.19	324.84	7.71
966	9-15 PRI	969	SW UP	FDR	.03	14.10	322.67	7.66
969	SW UP	966	9-15 PRI	FDR	.03	14.10	322.56	7.66
969	SW UP	972	SW DOWN	FDR	.00	14.10	322.56	3.03
972	SW DOWN	969	SW UP	FDR	.00	14.10	322.56	3.03
972	SW DOWN	975	9-16 PRI	FDR	.47	14.10	322.56	7.66
975	9-16 PRI	972	SW DOWN	FDR	.47	14.10	321.04	7.66
975	9-16 PRI	977	9-19 PRI	FDR	.03	.75	17.18	.41
975	9-16 PRI	980		FDR	.19	13.34	303.86	7.25
977	9-19 PRI	975	9-16 PRI	FDR	.03	.75	17.17	.41
980		975	9-16 PRI	FDR	.19	13.34	303.30	7.25
980		982	9-20 PRI	FDR	.00	.28	6.42	.15
980		983	9-25 PRI	FDR	.31	13.06	296.88	7.10
982	9-20 PRI	980		FDR	.00	.28	6.42	.15
983	9-25 PRI	980		FDR	.31	13.06	295.94	7.10
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW

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CASE 2 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSEM
FORT GREELY, ALASKA - 1995 TO 1997 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VDX	AMPS	KVA	RATING%
983	9-25 PRI	985	9-34 PRI	FDR	.04	5.64	127.82	3.07
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.04	5.64	127.76	3.07
985	9-34 PRI	987		FDR	.13	5.15	116.72	2.80
987		985	9-34 PRI	FDR	.13	5.15	116.57	2.80
987		990	9-26 PRI	FDR	.08	2.10	47.54	1.14
987		992		FDR	.33	3.05	69.03	1.66
990	9-26 PRI	987		FDR	.08	2.10	47.50	1.14
992		987		FDR	.33	3.05	68.80	1.66
992		995	9-30 PRI	FDR	.23	2.10	47.28	1.75
992		997	9-32 PRI	FDR	.02	.95	21.52	.52
995	9-30 PRI	992		FDR	.23	2.10	47.17	1.75
997	9-32 PRI	992		FDR	.02	.95	21.51	.52

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

130 BUSES

*** TOTAL SYSTEM LOSSES ***
44.2 KW 242.8 KVAR

APPENDIX H

Load Flow Analysis - Case 3

CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 27 NOV 95
TIME: 9 10 AM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)
COPYRIGHT SKM SYSTEMS ANALYSIS, INC. 1983

DATE: 27 NOV 95 TIME: 9 10 AM PAGE 2
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS
BUS NO ID STAT VOLTAGE ANGLE
=====

80	6	1	1.000	.000
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=====

PV GENERATORS
BUS NO ID STAT VOLTAGE KW KVARMIN KVARMAX PARTICIPATION
=====

10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000

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NOTICE: BRANCH 725 7-15 PRI TO 730 F7 L43 IS OUT OF SERVICE
NOTICE: BRANCH 735 F7 L54 TO 740 7-17 PRI IS OUT OF SERVICE
NOTICE: BRANCH 750 F7 L72 TO 755 F7-33 IS OUT OF SERVICE
NOTICE: BRANCH 745 TO 760 7-21 PRI IS OUT OF SERVICE
NOTICE: BRANCH 760 7-21 PRI TO 765 7-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 765 7-22 PRI TO 770 7-23 PRI IS OUT OF SERVICE
NOTICE: BRANCH 770 7-23 PRI TO 775 7-24 PRI IS OUT OF SERVICE
NOTICE: BRANCH 800 FDR 8 TO 805 F8 L11 IS OUT OF SERVICE
NOTICE: BRANCH 805 F8 L11 TO 810 F8 L23 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 815 F8 L25 IS OUT OF SERVICE
NOTICE: BRANCH 810 F8 L23 TO 817 F8 22 IS OUT OF SERVICE
NOTICE: BRANCH 820 F8 30 UF1 TO 825 8-22 PRI IS OUT OF SERVICE
NOTICE: BRANCH 920 F940 TO 925 () IS OUT OF SERVICE
NOTICE: BRANCH 945 F949 L1 TO 950 9-12 PRI IS OUT OF SERVICE
NOTICE: BRANCH 950 9-12 PRI TO 955 9-11 PRI IS OUT OF SERVICE
NOTICE: BRANCH 975 9-16 PRI TO 977 9-19 PRI IS OUT OF SERVICE
NOTICE: BRANCH 980 TO 982 9-20 PRI IS OUT OF SERVICE
NOTICE: BRANCH 992 TO 995 9-30 PRI IS OUT OF SERVICE
NOTICE: BRANCH 121 F1 L63 TO 125 F1 L67 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 130 F1 L613 IS OUT OF SERVICE
NOTICE: BRANCH 125 F1 L67 TO 135 F1 L68 IS OUT OF SERVICE
NOTICE: BRANCH 205 TO 210 2-3 PRI IS OUT OF SERVICE
NOTICE: BRANCH 400 FDR 4 TO 401 4-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 305 F8 F311 TO 310 F3 19 IS OUT OF SERVICE
NOTICE: BRANCH 405 F4 10 TO 410 F417 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 505 F4 F5 F6UF TO 510 5-1 PRI IS OUT OF SERVICE
NOTICE: BRANCH 515 F5 L24 TO 520 5-6 PRI IS OUT OF SERVICE
NOTICE: BRANCH 525 F5 L31 TO 530 F5 L39 IS OUT OF SERVICE
NOTICE: BRANCH 535 F537 L5 TO 540 F5 L5 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 545 F5 L56 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 540 F5 L5 UF1 TO 550 F5 L55 IS OUT OF SERVICE
NOTICE: BRANCH 565 5-17 PRI TO 570 5-18 PRI IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 585 F5 L87 UF1 IS OUT OF SERVICE
NOTICE: BRANCH 580 F5 L85 TO 590 F5 L8911 IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911 TO 595 F5 L8 25 IS OUT OF SERVICE

DATE: 27 NOV 95 TIME: 9 10 AM PAGE 3
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

NOTICE: BRANCH 303 F713	TO 305 F8 F311	IS OUT OF SERVICE
NOTICE: BRANCH 817 F8 22	TO 820 F8 30 UF1	IS OUT OF SERVICE
NOTICE: BRANCH 210 2-3 PRI	TO 215 2-4 PRI	IS OUT OF SERVICE
NOTICE: BRANCH 215 2-4 PRI	TO 220 2-5 PRI	IS OUT OF SERVICE
NOTICE: BRANCH 512 5-3 PRI	TO 514 5-5 PRI	IS OUT OF SERVICE
NOTICE: BRANCH 210 2-3 PRI	TO 225 2-3 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 215 2-4 PRI	TO 230 2-4 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 410 F417 UF1	TO 415 4-6 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 545 F5 L56 UF1	TO 547 5-16 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911	TO 591 5-23 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 590 F5 L8911	TO 593 5-24 SEC	IS OUT OF SERVICE
NOTICE: BRANCH 300 FDR 3	TO 301 F8 F311	IS OUT OF SERVICE
NOTICE: BRANCH 301 F8 F311	TO 303 F713	IS OUT OF SERVICE
NOTICE: BRANCH 401 4-1 PRI	TO 403 F1 F45	IS OUT OF SERVICE
NOTICE: BRANCH 403 F1 F45	TO 405 F4 10	IS OUT OF SERVICE

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
10 GEN G1 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
20 GEN G2 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
30 GEN G3 IMPEDANCE:	60 SWGR S .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
40 GEN G4 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
50 GEN G5 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	66 SM1A BLUE .0300 + J	1 .0526	2400. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	70 SWGR N .0300 + J	1 .0526	2400. OHMS/M FEET	5. FT	500 C M XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	100 FDR 1 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0 A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	200 FDR 2 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0 A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	300 FDR 3 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0 A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	400 FDR 4 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0 A N XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	500 FDR 5 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0 A N XLP STATUS: EXISTING
62 SS-1 SEC IMPEDANCE:	64 MCC 4&5 .0300 + J	1 .0526	480. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
64 MCC 4&5 IMPEDANCE:	68 BLUE SSS .0300 + J	1 .0526	480. OHMS/M FEET	50. FT	500 C M XLP STATUS: EXISTING
70 SWGR N IMPEDANCE:	90 SWGR O .0453 + J	1 .0444	2400. OHMS/M FEET	10. FT	500 A M XLP STATUS: EXISTING

DATE: 27 NOV 95 TIME: 9 10 AM PAGE 5
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
85 T1 SEC IMPEDANCE:	90 SWGR O .0453 + J	1 .0444	2400. OHMS/M FEET	10. FT	500	A M XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	600 O/H BUS .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	700 FDR 7 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	800 FDR 8 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	900 FDR 9 .1050 + J	1 .0410	2400. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
100 FDR 1 IMPEDANCE:	105 F1F12 14 .0900 + J	1 .1200	2400. OHMS/M FEET	1500. FT	4/0	A B OH-2 STATUS: EXISTING
105 F1F12 14 IMPEDANCE:	110 F1 L14 .0900 + J	1 .1200	2400. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	115 F1 L15 .0900 + J	1 .1200	2400. OHMS/M FEET	300. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	120 F1 L31 .0900 + J	1 .1200	2400. OHMS/M FEET	400. FT	4/0	A B OH-2 STATUS: EXISTING
120 F1 L31 IMPEDANCE:	121 F1 L63 .0900 + J	1 .1200	2400. OHMS/M FEET	450. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	122 F1 L64 .0900 + J	1 .1200	2400. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
200 FDR 2 IMPEDANCE:	205 .0900 + J	1 .1200	2400. OHMS/M FEET	600. FT	4/0	A B OH-2 STATUS: EXISTING
205 IMPEDANCE:	235 F5 F29 .0900 + J	1 .1200	2400. OHMS/M FEET	400. FT	4/0	A B OH-2 STATUS: EXISTING
235 F5 F29 IMPEDANCE:	236 F2 F211 .0900 + J	1 .1200	2400. OHMS/M FEET	250. FT	4/0	A B OH-2 STATUS: EXISTING
236 F2 F211 IMPEDANCE:	240 F1 F213 .0900 + J	1 .1200	2400. OHMS/M FEET	250. FT	4/0	A B OH-2 STATUS: EXISTING

DATE:27 NOV 95 TIME: 9 10 AM PAGE 6
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
500 FDR 5 IMPEDANCE:	505 F4 F5 F6UF .0900 + J	1 .1200	2400. OHMS/M	625. FT FEET	4/0	A B OH-2 STATUS: EXISTING
505 F4 F5 F6UF IMPEDANCE:	512 5-3 PRI .0900 + J	1 .1200	2400. OHMS/M	1600. FT FEET	4/0	A B OH-2 STATUS: EXISTING
512 5-3 PRI IMPEDANCE:	515 F5 L24 .0900 + J	1 .1200	2400. OHMS/M	1200. FT FEET	4/0	A B OH-2 STATUS: EXISTING
515 F5 L24 IMPEDANCE:	525 F5 L31 .0900 + J	1 .1200	2400. OHMS/M	200. FT FEET	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE:	531 F3 L41 .0900 + J	1 .1200	2400. OHMS/M	500. FT FEET	4/0	A B OH-2 STATUS: EXISTING
525 F5 L31 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200	2400. OHMS/M	1400. FT FEET	4/0	A B OH-2 STATUS: EXISTING
531 F3 L41 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200	2400. OHMS/M	900. FT FEET	4/0	A B OH-2 STATUS: EXISTING
535 F537 L5 IMPEDANCE:	555 .1410 + J	1 .1250	2400. OHMS/M	800. FT FEET	2/0	A B OH-2 STATUS: EXISTING
555 IMPEDANCE:	560 RICH SUB .1410 + J	1 .1250	2400. OHMS/M	3200. FT FEET	2/0	A B OH-2 STATUS: EXISTING
555 IMPEDANCE:	565 5-17 PRI .1410 + J	1 .1250	2400. OHMS/M	800. FT FEET	2/0	A B OH-2 STATUS: EXISTING
562 RS SEC IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380	7200. OHMS/M	5. FT FEET	4	A B OH-2 STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	575 F5 51 .1410 + J	1 .1250	2400. OHMS/M	300. FT FEET	2/0	A B OH-2 STATUS: EXISTING
575 F5 51 IMPEDANCE:	580 F5 L85 .1410 + J	1 .1250	2400. OHMS/M	600. FT FEET	2/0	A B OH-2 STATUS: EXISTING
700 FDR 7 IMPEDANCE:	705 WELL9 POL .0900 + J	1 .1200	2400. OHMS/M	50. FT FEET	4/0	A B OH-2 STATUS: EXISTING
705 WELL9 POL IMPEDANCE:	709 F9 F73 .0900 + J	1 .1200	2400. OHMS/M	200. FT FEET	4/0	A B OH-2 STATUS: EXISTING

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
709 F9 F73 IMPEDANCE:	710 F7 L11 .0900 + J	1 .1200 OHMS/M FEET	2400.	1000. FT	4/0	A B	OH-2	STATUS: EXISTING
710 F7 L11 IMPEDANCE:	715 F7 L13 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B	OH-2	STATUS: EXISTING
710 F7 L11 IMPEDANCE:	720 F713 .0900 + J	1 .1200 OHMS/M FEET	2400.	500. FT	4/0	A B	OH-2	STATUS: EXISTING
720 F713 IMPEDANCE:	725 7-15 PRI .0900 + J	1 .1200 OHMS/M FEET	2400.	1200. FT	4/0	A B	OH-2	STATUS: EXISTING
725 7-15 PRI IMPEDANCE:	735 F7 L54 .0900 + J	1 .1200 OHMS/M FEET	2400.	350. FT	4/0	A B	OH-2	STATUS: EXISTING
735 F7 L54 IMPEDANCE:	745 .0900 + J	1 .1200 OHMS/M FEET	2400.	625. FT	4/0	A B	OH-2	STATUS: EXISTING
745 IMPEDANCE:	750 F7 L72 .0900 + J	1 .1200 OHMS/M FEET	2400.	525. FT	4/0	A B	OH-2	STATUS: EXISTING
905 STEP SEC IMPEDANCE:	910 F 96 .0900 + J	1 .1200 OHMS/M FEET	7200.	600. FT	4/0	A B	OH-2	STATUS: EXISTING
910 F 96 IMPEDANCE:	915 F910 .0900 + J	1 .1200 OHMS/M FEET	7200.	800. FT	4/0	A B	OH-2	STATUS: EXISTING
915 F910 IMPEDANCE:	920 F940 .0900 + J	1 .1200 OHMS/M FEET	7200.	4500. FT	4/0	A B	OH-2	STATUS: EXISTING
920 F940 IMPEDANCE:	945 F949 L1 .0900 + J	1 .1200 OHMS/M FEET	7200.	800. FT	4/0	A B	OH-2	STATUS: EXISTING
925 () IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	7200.	1500. FT	4	A B	OH-2	STATUS: EXISTING
925 () IMPEDANCE:	935 9-8 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	1000. FT	6	A B	OH-2	STATUS: EXISTING
935 9-8 PRI IMPEDANCE:	940 9-9 PRI .6900 + J	1 .1440 OHMS/M FEET	7200.	5000. FT	6	A B	OH-2	STATUS: EXISTING
945 F949 L1 IMPEDANCE:	960 9-13 PRI .2760 + J	1 .1320 OHMS/M FEET	7200.	2200. FT	2	A B	OH-2	STATUS: EXISTING

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
960 9-13 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	963 9-14 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	7600. FT 2	A B OH-2 STATUS: EXISTING
963 9-14 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	966 9-15 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	2200. FT 2	A B OH-2 STATUS: EXISTING
966 9-15 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	969 SW UP IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	600. FT 2	A B OH-2 STATUS: EXISTING
969 SW UP IMPEDANCE: .0300 + J .0526 OHMS/M FEET	972 SW DOWN IMPEDANCE: .0300 + J .0526 OHMS/M FEET	1	7200.	5. FT 500	C M XLP STATUS: EXISTING
972 SW DOWN IMPEDANCE: .2760 + J .1320 OHMS/M FEET	975 9-16 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	8400. FT 2	A B OH-2 STATUS: EXISTING
975 9-16 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	980 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	3500. FT 2	A B OH-2 STATUS: EXISTING
980 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	983 9-25 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	6000. FT 2	A B OH-2 STATUS: EXISTING
983 9-25 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	985 9-34 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	2000. FT 2	A B OH-2 STATUS: EXISTING
985 9-34 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	987 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	6400. FT 2	A B OH-2 STATUS: EXISTING
987 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	990 9-26 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	9800. FT 2	A B OH-2 STATUS: EXISTING
987 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	992 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	27000. FT 2	A B OH-2 STATUS: EXISTING
992 IMPEDANCE: .2760 + J .1320 OHMS/M FEET	997 9-32 PRI IMPEDANCE: .2760 + J .1320 OHMS/M FEET	1	7200.	5000. FT 2	A B OH-2 STATUS: EXISTING

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

TRANSFORMER DATA						
PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
60 SWGR S IMPEDANCE:	2400. .7816 + J 4.5331	72. PERCENT	62 SS-1 SEC	480.	361.	300.0
66 SM1A BLUE IMPEDANCE:	2400. .8156 + J 4.7302	120. PERCENT	68 BLUE SSS	480.	601.	500.0
80 UTILITY IMPEDANCE:	24900. .5546 + J 5.9341	58. PERCENT	85 T1 SEC	2400.	601.	2500.0
					TRANSFORMER FIXED TAP: -5.0 %	
90 SWGR O IMPEDANCE:	2400. .5709 + J 3.3111	72. PERCENT	64 MCC 4&5	480.	361.	300.0
560 RICH SUB IMPEDANCE:	2400. .9345 + J 5.4200	144. PERCENT	562 RS SEC	7200.	48.	600.0
705 WELL9 POL IMPEDANCE:	2400. .9345 + J 5.4200	36. PERCENT	707 7-1 SEC	480.	180.	150.0
900 FDR 9 IMPEDANCE:	2400. .7816 + J 4.5331	361. PERCENT	905 STEP SEC	7200.	120.	1500.0
983 9-25 PRI IMPEDANCE:	7200. .9345 + J 5.4200	40. PERCENT	984 9-25 SEC	208.	1388.	500.0

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B U S S P E C I A L S T U D Y D A T A

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=====
* NO * NAME * KW * KVAR * LOAD TYPE
=====
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120	F1 L31	43.	14.	CONSTANT Z LOAD
121	F1 L63	43.	14.	CONSTANT Z LOAD
122	F1 L64	74.	24.	CONSTANT Z LOAD
235	F5 F29	44.	14.	CONSTANT Z LOAD
236	F2 F211	88.	29.	CONSTANT Z LOAD
240	F1 F213	88.	29.	CONSTANT Z LOAD
525	F5 L31	8.	3.	CONSTANT Z LOAD
565	5-17 PRI	5.	2.	CONSTANT Z LOAD
580	F5 L85	8.	3.	CONSTANT Z LOAD
705	WELL9 POL	41.	14.	CONSTANT Z LOAD
709	F9 F73	83.	27.	CONSTANT Z LOAD
710	F7 L11	21.	7.	CONSTANT Z LOAD
715	F7 L13	21.	7.	CONSTANT Z LOAD
735	F7 L54	8.	3.	CONSTANT Z LOAD
750	F7 L72	21.	7.	CONSTANT Z LOAD
910	F 96	18.	6.	CONSTANT Z LOAD
935	9-8 PRI	10.	3.	CONSTANT Z LOAD
940	9-9 PRI	15.	5.	CONSTANT Z LOAD
945	F949 L1	4.	1.	CONSTANT Z LOAD
963	9-14 PRI	18.	6.	CONSTANT Z LOAD
983	9-25 PRI	157.	51.	CONSTANT Z LOAD
990	9-26 PRI	34.	11.	CONSTANT Z LOAD
997	9-32 PRI	24.	8.	CONSTANT Z LOAD

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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*** SOLUTION COMMENTS ***
=====

SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA	:	4.00 %
BUS VOLTAGE CRITERIA	:	5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS	:	1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS:	:	1.00
EXACT(ITERATIVE) SOLUTION	:	YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 292

LARGEST LOAD:	1000.00 KVA	
CONVERGENCE CRITERIA:	.050 KVA	
LARGEST BUS MISMATCH	10 GEN G1	94.178 KVA
LARGEST BUS MISMATCH	10 GEN G1	2.094 KVA
LARGEST BUS MISMATCH	10 GEN G1	.047 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	-61.0	320.0	.0	

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)

- BUS NAME	ID	---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
		SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.046	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.046	.0	.0	.0	.0
30 GEN G3	3	1.000	1.046	.0	.0	.0	.0
40 GEN G4	4	1.000	1.046	.0	.0	.0	.0
50 GEN G5	5	1.000	1.046	.0	.0	.0	.0

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FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 10 GEN G1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2510 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
** PV TYPE GENERATOR: 1 1000.0 KW .0 KVAR

LOAD TO: 60 SWGR S FEEDER AMPS: 230 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 1000.0 KW .0 KVAR 1000.0 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

==== BUS: 20 GEN G2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
** PV TYPE GENERATOR: 2 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 30 GEN G3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
** PV TYPE GENERATOR: 3 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 40 GEN G4 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
** PV TYPE GENERATOR: 4 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 50 GEN G5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
** PV TYPE GENERATOR: 5 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 60 SWGR S DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 10 GEN G1 FEEDER AMPS: 230 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 999.8 KW -.4 KVAR 999.8 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

LOAD FROM: 20 GEN G2 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD FROM: 30 GEN G3	FEEDER AMPS:	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	.0 KW .0 KVAR	.0 KVA	PF: .00	LEADING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 62 SS-1 SEC	TRANSF AMPS:	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	.2 KW .0 KVAR	.2 KVA	PF: .97	LAGGING
LOSSES THRU TRANSF:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 66 SM1A BLUE	FEEDER AMPS:	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	.3 KW .1 KVAR	.3 KVA	PF: .97	LAGGING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 70 SWGR W	FEEDER AMPS: 129	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	538.1 KW -156.0 KVAR	560.3 KVA	PF: .96	LEADING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 100 FDR 1	FEEDER AMPS: 42	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	171.9 KW 57.6 KVAR	181.3 KVA	PF: .95	LAGGING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 200 FDR 2	FEEDER AMPS: 58	VOLTAGE DROP:	1. %VD:	.0
PROJECTED POWER FLOW:	238.7 KW 79.2 KVAR	251.5 KVA	PF: .95	LAGGING
LOSSES THRU FEEDER:	.1 KW .0 KVAR	.1 KVA		

LOAD FROM: 300 FDR 3	FEEDER AMPS:	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	.0 KW .0 KVAR	.0 KVA	PF: .00	LEADING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD FROM: 400 FDR 4	FEEDER AMPS:	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	.0 KW .0 KVAR	.0 KVA	PF: .00	LEADING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

LOAD TO: 500 FDR 5	FEEDER AMPS: 12	VOLTAGE DROP:	0. %VD:	.0
PROJECTED POWER FLOW:	50.6 KW 18.7 KVAR	53.9 KVA	PF: .94	LAGGING
LOSSES THRU FEEDER:	.0 KW .0 KVAR	.0 KVA		

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 62 SS-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 502 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 64 MCC 4&5 DESIGN VOLTAGE: 480 BUS VOLTAGE: 502 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 62 SS-1 SEC FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .0 KVAR .2 KVA PF: .97 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 68 BLUE SSS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .1 KVAR .3 KVA PF: .97 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 90 SWGR 0 TRANSF AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .5 KW .1 KVAR .5 KVA PF: .97 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 66 SM1A BLUE DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .1 KVAR .3 KVA PF: .97 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 68 BLUE SSS TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .1 KVAR .3 KVA PF: .97 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

==== BUS: 68 BLUE SSS DESIGN VOLTAGE: 480 BUS VOLTAGE: 502 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD TO: 64 MCC 4&5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .1 KVAR .3 KVA PF: .97 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 66 SM1A BLUE TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .3 KW .1 KVAR .3 KVA PF: .97 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 70 SWGR N DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 40 GEN G4 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 50 GEN G5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 60 SWGR S FEEDER AMPS: 129 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 538.1 KW -156.1 KVAR 560.3 KVA PF: .96 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 90 SWGR O FEEDER AMPS: 129 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 538.1 KW -156.1 KVAR 560.3 KVA PF: .96 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 80 UTILITY DESIGN VOLTAGE: 24900 BUS VOLTAGE: 24900 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: .0 DEGREES
*** SWING GENERATOR: 6 -61.0 KW 320.0 KVAR

LOAD FROM: 85 T1 SEC TRANSF AMPS: 8 VOLTAGE DROP: 1134. %VD: 4.6\$
PROJECTED POWER FLOW: 61.0 KW -320.0 KVAR 325.8 KVA PF: .19 LEADING
LOSSES THRU TRANSF: .2 KW 2.3 KVAR 2.3 KVA **XFMR TAPS -5.0%**

==== BUS: 85 T1 SEC DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD TO: 80 UTILITY TRANSF AMPS: 74 VOLTAGE DROP: 109. %VD: 4.6\$
PROJECTED POWER FLOW: 61.2 KW -317.7 KVAR 323.6 KVA PF: .19 LEADING
LOSSES THRU TRANSF: .2 KW 2.3 KVAR 2.3 KVA **XFMR TAPS -5.0%**

LOAD FROM: 90 SWGR O FEEDER AMPS: 74 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 61.2 KW -317.7 KVAR 323.6 KVA PF: .19 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 90 SWGR 0 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 64 MCC 4&5 TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .5 KW .1 KVAR .5 KVA PF: .97 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 70 SWGR N FEEDER AMPS: 129 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 538.1 KW -156.1 KVAR 560.3 KVA PF: .96 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 85 T1 SEC FEEDER AMPS: 74 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 61.2 KW -317.7 KVAR 323.6 KVA PF: .19 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 600 O/H BUS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 700 FDR 7 FEEDER AMPS: 52 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 212.6 KW 70.6 KVAR 224.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 800 FDR 8 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 900 FDR 9 FEEDER AMPS: 64 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 264.8 KW 91.1 KVAR 280.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 100 FDR 1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 42 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 171.8 KW 57.6 KVAR 181.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 105 F1F12 14 FEEDER AMPS: 42 VOLTAGE DROP: 13. %VD: .6
PROJECTED POWER FLOW: 171.8 KW 57.6 KVAR 181.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .9 KVAR 1.2 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 105 F1F12 14 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2496 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES

LOAD FROM: 100 FDR 1 FEEDER AMPS: 42 VOLTAGE DROP: 13. %VD: .6
PROJECTED POWER FLOW: 171.1 KW 56.7 KVAR 180.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .9 KVAR 1.2 KVA

LOAD TO: 110 F1 L14 FEEDER AMPS: 42 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 171.1 KW 56.7 KVAR 180.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

==== BUS: 110 F1 L14 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2494 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES

LOAD FROM: 105 F1F12 14 FEEDER AMPS: 42 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 171.0 KW 56.5 KVAR 180.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

LOAD FROM: 115 F1 L15 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 120 F1 L31 FEEDER AMPS: 42 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 171.0 KW 56.5 KVAR 180.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .3 KVA

==== BUS: 115 F1 L15 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2494 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 120 F1 L31 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2490 %VD: -3.8
===== PU BUS VOLTAGE: 1.038 ANGLE: -.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 45.8 KW 15.1 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 42 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 170.9 KW 56.3 KVAR 179.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .3 KVA

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 121 F1 L63 FEEDER AMPS: 31 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 125.0 KW 41.2 KVAR 131.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 121 F1 L63 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2487 %VD: -3.6
===== PU BUS VOLTAGE: 1.036 ANGLE: -.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 45.7 KW 15.0 KVAR

LOAD FROM: 120 F1 L31 FEEDER AMPS: 31 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 124.9 KW 41.1 KVAR 131.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 122 F1 L64 FEEDER AMPS: 19 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 79.2 KW 26.0 KVAR 83.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 122 F1 L64 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2486 %VD: -3.6
===== PU BUS VOLTAGE: 1.036 ANGLE: -.2 DEGREES
PROJECTED SPECIAL BUS LOAD: 79.1 KW 26.0 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 19 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 79.1 KW 26.0 KVAR 83.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 200 FDR 2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 58 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 238.6 KW 79.2 KVAR 251.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 205 FEEDER AMPS: 58 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 238.6 KW 79.2 KVAR 251.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

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FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 205 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2501 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 200 FDR 2 FEEDER AMPS: 58 VOLTAGE DROP: 7. %VD: .3
PROJECTED POWER FLOW: 238.1 KW 78.5 KVAR 250.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .7 KVAR .9 KVA

LOAD TO: 235 F5 F29 FEEDER AMPS: 58 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 238.1 KW 78.5 KVAR 250.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

==== BUS: 235 F5 F29 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2496 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 47.6 KW 15.1 KVAR

LOAD FROM: 205 FEEDER AMPS: 58 VOLTAGE DROP: 5. %VD: .2
PROJECTED POWER FLOW: 237.7 KW 78.0 KVAR 250.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .4 KW .5 KVAR .6 KVA

LOAD TO: 236 F2 F211 FEEDER AMPS: 46 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 190.1 KW 62.8 KVAR 200.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 236 F2 F211 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2494 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 95.0 KW 31.3 KVAR

LOAD FROM: 235 F5 F29 FEEDER AMPS: 46 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 190.0 KW 62.6 KVAR 200.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 240 F1 F213 FEEDER AMPS: 23 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 95.0 KW 31.3 KVAR 100.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 240 F1 F213 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2493 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 94.9 KW 31.3 KVAR

LOAD FROM: 236 F2 F211 FEEDER AMPS: 23 VOLTAGE DROP: 1. %VD: .1
PROJECTED POWER FLOW: 94.9 KW 31.3 KVAR 100.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 300 FDR 3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 400 FDR 4 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 500 FDR 5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 12 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 50.6 KW 18.7 KVAR 53.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 505 F4 F5 F6UF FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 50.6 KW 18.7 KVAR 53.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 505 F4 F5 F6UF DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2508 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 500 FDR 5 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 50.5 KW 18.6 KVAR 53.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 512 5-3 PRI FEEDER AMPS: 12 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 50.5 KW 18.6 KVAR 53.9 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 512 5-3 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2503 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 12 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 50.5 KW 18.5 KVAR 53.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 515 F5 L24 FEEDER AMPS: 12 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 50.5 KW 18.5 KVAR 53.8 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

==== BUS: 515 F5 L24 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2500 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 12 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 50.4 KW 18.5 KVAR 53.7 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 525 F5 L31 FEEDER AMPS: 12 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 50.4 KW 18.5 KVAR 53.7 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 525 F5 L31 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2499 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.7 KW 3.6 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 12 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 50.4 KW 18.5 KVAR 53.7 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 531 F3 L41 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 20.9 KW 7.5 KVAR 22.2 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 5 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 20.9 KW 7.5 KVAR 22.2 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 531 F3 L41 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2499 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: .0 DEGREES

LOAD FROM: 525 F5 L31 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 20.9 KW 7.4 KVAR 22.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 20.9 KW 7.4 KVAR 22.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 535 F537 L5 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2498 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: -.1 DEGREES

LOAD FROM: 525 F5 L31 FEEDER AMPS: 5 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 20.9 KW 7.4 KVAR 22.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 531 F3 L41 FEEDER AMPS: 5 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 20.9 KW 7.4 KVAR 22.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 555 FEEDER AMPS: 10 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 41.7 KW 14.9 KVAR 44.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 555 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2495 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES

LOAD FROM: 535 F537 L5 FEEDER AMPS: 10 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 41.7 KW 14.9 KVAR 44.2 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 560 RICH SUB FEEDER AMPS: 7 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 27.6 KW 9.2 KVAR 29.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 565 5-17 PRI FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 14.0 KW 5.7 KVAR 15.1 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 560 RICH SUB DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2489 %VD: -3.7
===== PU BUS VOLTAGE: 1.037 ANGLE: -.1 DEGREES

LOAD FROM: 555 FEEDER AMPS: 7 VOLTAGE DROP: 6. %VD: .3
PROJECTED POWER FLOW: 27.6 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 562 RS SEC TRANSF AMPS: 7 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 27.6 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

==== BUS: 562 RS SEC DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7458 %VD: -3.6
===== PU BUS VOLTAGE: 1.036 ANGLE: -.3 DEGREES

LOAD FROM: 560 RICH SUB TRANSF AMPS: 2 VOLTAGE DROP: 9. %VD: .1
PROJECTED POWER FLOW: 27.5 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

LOAD TO: 930 RICH SUB FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 565 5-17 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2495 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.4 KW 2.1 KVAR

LOAD FROM: 555 FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 14.0 KW 5.7 KVAR 15.1 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 575 F5 51 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.6 KW 3.5 KVAR 9.3 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 575 F5 51 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2494 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.6 KW 3.5 KVAR 9.3 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 580 F5 L85 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.6 KW 3.5 KVAR 9.3 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 580 F5 L85 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2494 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.6 KW 3.5 KVAR

LOAD FROM: 575 F5 51 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.6 KW 3.5 KVAR 9.3 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 600 O/H BUS DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 700 FDR 7 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 52 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 212.6 KW 70.6 KVAR 224.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 705 WELL9 POL FEEDER AMPS: 52 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 212.6 KW 70.6 KVAR 224.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 705 WELL9 POL DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2508 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
PROJECTED SPECIAL BUS LOAD: 44.8 KW 15.3 KVAR

LOAD FROM: 700 FDR 7 FEEDER AMPS: 52 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 212.5 KW 70.6 KVAR 223.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD FROM: 707 7-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 709 F9 F73 FEEDER AMPS: 41 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 167.8 KW 55.3 KVAR 176.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 707 7-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 502 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 709 F9 F73 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2506 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.5 KW 29.4 KVAR

LOAD FROM: 705 WELL9 POL FEEDER AMPS: 41 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 167.7 KW 55.2 KVAR 176.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 710 F7 L11 FEEDER AMPS: 19 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 77.1 KW 25.7 KVAR 81.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

==== BUS: 710 F7 L11 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2502 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.5 KW 7.4 KVAR

LOAD FROM: 709 F9 F73 FEEDER AMPS: 19 VOLTAGE DROP: 4. %VD: .2
PROJECTED POWER FLOW: 77.0 KW 25.6 KVAR 81.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .2 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 715 F7 L13 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 720 F713 FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.6 KVAR 33.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 715 F7 L13 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2502 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.8 KW 7.6 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 720 F713 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2502 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 710 F7 L11 FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.7 KW 10.6 KVAR 33.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 725 7-15 PRI FEEDER AMPS: 8 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 31.7 KW 10.6 KVAR 33.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 725 7-15 PRI DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2500 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 720 F713 FEEDER AMPS: 8 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 31.7 KW 10.6 KVAR 33.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 735 F7 L54 FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.7 KW 10.6 KVAR 33.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED
VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 735 F7 L54 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2499 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 9.0 KW 2.9 KVAR

LOAD FROM: 725 7-15 PRI FEEDER AMPS: 8 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.7 KW 10.5 KVAR 33.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 745 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 745 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2498 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: -.1 DEGREES

LOAD FROM: 735 F7 L54 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.7 KW 7.6 KVAR 24.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 750 F7 L72 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.7 KW 7.6 KVAR 24.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 750 F7 L72 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2498 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.7 KW 7.6 KVAR

LOAD FROM: 745 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 22.7 KW 7.6 KVAR 24.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 800 FDR 8 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.6
===== PU BUS VOLTAGE: 1.046 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 900 FDR 9 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2509 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 64 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 264.7 KW 91.1 KVAR 280.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 905 STEP SEC TRANSF AMPS: 64 VOLTAGE DROP: 9. %VD: .4
PROJECTED POWER FLOW: 264.7 KW 91.1 KVAR 280.0 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .4 KW 2.2 KVAR 2.2 KVA

==== BUS: 905 STEP SEC DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7498 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: -.3 DEGREES

LOAD FROM: 900 FDR 9 TRANSF AMPS: 21 VOLTAGE DROP: 28. %VD: .4
PROJECTED POWER FLOW: 264.3 KW 88.9 KVAR 278.9 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .4 KW 2.2 KVAR 2.2 KVA

LOAD TO: 910 F 96 FEEDER AMPS: 21 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 264.3 KW 88.9 KVAR 278.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 910 F 96 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7495 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: -.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 19.3 KW 6.3 KVAR

LOAD FROM: 905 STEP SEC FEEDER AMPS: 21 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 264.3 KW 88.8 KVAR 278.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 915 F910 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 245.0 KW 82.5 KVAR 258.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 915 F910 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7491 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.3 DEGREES

LOAD FROM: 910 F 96 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 244.9 KW 82.4 KVAR 258.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 920 F940 FEEDER AMPS: 20 VOLTAGE DROP: 19. %VD: .3
PROJECTED POWER FLOW: 244.9 KW 82.4 KVAR 258.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .6 KVAR .8 KVA

==== BUS: 920 F940 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7472 %VD: -3.8
===== PU BUS VOLTAGE: 1.038 ANGLE: -.4 DEGREES

LOAD FROM: 915 F910 FEEDER AMPS: 20 VOLTAGE DROP: 19. %VD: .3
PROJECTED POWER FLOW: 244.4 KW 81.7 KVAR 257.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .6 KVAR .8 KVA

LOAD TO: 945 F949 L1 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 244.4 KW 81.7 KVAR 257.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 925 () DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7455 %VD: -3.5
===== PU BUS VOLTAGE: 1.035 ANGLE: -.3 DEGREES

LOAD FROM: 930 RICH SUB FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.0 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 935 9-8 PRI FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.0 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 930 RICH SUB DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7458 %VD: -3.6
===== PU BUS VOLTAGE: 1.036 ANGLE: -.3 DEGREES

LOAD FROM: 562 RS SEC FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 925 () FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.1 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 935 9-8 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7453 %VD: -3.5
===== PU BUS VOLTAGE: 1.035 ANGLE: -.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 11.0 KW 3.6 KVAR

LOAD FROM: 925 () FEEDER AMPS: 2 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 27.5 KW 9.0 KVAR 29.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 940 9-9 PRI FEEDER AMPS: 1 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 16.5 KW 5.4 KVAR 17.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 940 9-9 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7444 %VD: -3.4
===== PU BUS VOLTAGE: 1.034 ANGLE: -.3 DEGREES
PROJECTED SPECIAL BUS LOAD: 16.5 KW 5.4 KVAR

LOAD FROM: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 16.5 KW 5.4 KVAR 17.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 945 F949 L1 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7469 %VD: -3.7
===== PU BUS VOLTAGE: 1.037 ANGLE: -.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.7 KW 1.5 KVAR

LOAD FROM: 920 F940 FEEDER AMPS: 20 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 244.3 KW 81.6 KVAR 257.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 960 9-13 PRI FEEDER AMPS: 20 VOLTAGE DROP: 23. %VD: .3
PROJECTED POWER FLOW: 239.6 KW 80.1 KVAR 252.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .3 KVAR .8 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 960 9-13 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7446 %VD: -3.4
===== PU BUS VOLTAGE: 1.034 ANGLE: -.5 DEGREES

LOAD FROM: 945 F949 L1 FEEDER AMPS: 20 VOLTAGE DROP: 23. %VD: .3
PROJECTED POWER FLOW: 238.9 KW 79.8 KVAR 251.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .3 KVAR .8 KVA

LOAD TO: 963 9-14 PRI FEEDER AMPS: 20 VOLTAGE DROP: 78. %VD: 1.1
PROJECTED POWER FLOW: 238.9 KW 79.8 KVAR 251.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.4 KW 1.1 KVAR 2.7 KVA

==== BUS: 963 9-14 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7368 %VD: -2.3
===== PU BUS VOLTAGE: 1.023 ANGLE: -.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 18.7 KW 6.1 KVAR

LOAD FROM: 960 9-13 PRI FEEDER AMPS: 20 VOLTAGE DROP: 78. %VD: 1.1
PROJECTED POWER FLOW: 236.5 KW 78.6 KVAR 249.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.4 KW 1.1 KVAR 2.7 KVA

LOAD TO: 966 9-15 PRI FEEDER AMPS: 18 VOLTAGE DROP: 21. %VD: .3
PROJECTED POWER FLOW: 217.9 KW 72.5 KVAR 229.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .3 KVAR .7 KVA

==== BUS: 966 9-15 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7347 %VD: -2.0
===== PU BUS VOLTAGE: 1.020 ANGLE: -.6 DEGREES

LOAD FROM: 963 9-14 PRI FEEDER AMPS: 18 VOLTAGE DROP: 21. %VD: .3
PROJECTED POWER FLOW: 217.3 KW 72.2 KVAR 229.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .6 KW .3 KVAR .7 KVA

LOAD TO: 969 SW UP FEEDER AMPS: 18 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 217.3 KW 72.2 KVAR 229.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 969 SW UP DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7342 %VD: -2.0
===== PU BUS VOLTAGE: 1.020 ANGLE: -.6 DEGREES

LOAD FROM: 966 9-15 PRI FEEDER AMPS: 18 VOLTAGE DROP: 6. %VD: .1
PROJECTED POWER FLOW: 217.1 KW 72.1 KVAR 228.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 972 SW DOWN FEEDER AMPS: 18 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 217.1 KW 72.1 KVAR 228.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 972 SW DOWN DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7342 %VD: -2.0
===== PU BUS VOLTAGE: 1.020 ANGLE: -.6 DEGREES

LOAD FROM: 969 SW UP FEEDER AMPS: 18 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 217.1 KW 72.1 KVAR 228.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 975 9-16 PRI FEEDER AMPS: 18 VOLTAGE DROP: 79. %VD: 1.1
PROJECTED POWER FLOW: 217.1 KW 72.1 KVAR 228.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.3 KW 1.1 KVAR 2.5 KVA

==== BUS: 975 9-16 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7262 %VD: -.9
===== PU BUS VOLTAGE: 1.009 ANGLE: -.6 DEGREES

LOAD FROM: 972 SW DOWN FEEDER AMPS: 18 VOLTAGE DROP: 79. %VD: 1.1
PROJECTED POWER FLOW: 214.9 KW 71.0 KVAR 226.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 2.3 KW 1.1 KVAR 2.5 KVA

LOAD TO: 980 FEEDER AMPS: 18 VOLTAGE DROP: 33. %VD: .5
PROJECTED POWER FLOW: 214.9 KW 71.0 KVAR 226.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW .4 KVAR 1.0 KVA

==== BUS: 980 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7229 %VD: -.4
===== PU BUS VOLTAGE: 1.004 ANGLE: -.7 DEGREES

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 18 VOLTAGE DROP: 33. %VD: .5
PROJECTED POWER FLOW: 213.9 KW 70.6 KVAR 225.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .9 KW .4 KVAR 1.0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 983 9-25 PRI FEEDER AMPS: 18 VOLTAGE DROP: 57. %VD: .8
PROJECTED POWER FLOW: 213.9 KW 70.6 KVAR 225.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW .8 KVAR 1.8 KVA

==== BUS: 983 9-25 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7172 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -.7 DEGREES
PROJECTED SPECIAL BUS LOAD: 155.3 KW 51.0 KVAR

LOAD FROM: 980 FEEDER AMPS: 18 VOLTAGE DROP: 57. %VD: .8
PROJECTED POWER FLOW: 212.3 KW 69.8 KVAR 223.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 1.6 KW .8 KVAR 1.8 KVA

LOAD TO: 984 9-25 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 985 9-34 PRI FEEDER AMPS: 5 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 57.0 KW 18.8 KVAR 60.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 984 9-25 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 207 %VD: .4
===== PU BUS VOLTAGE: .996 ANGLE: -.7 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 985 9-34 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7167 %VD: .5
===== PU BUS VOLTAGE: .995 ANGLE: -.7 DEGREES

LOAD FROM: 983 9-25 PRI FEEDER AMPS: 5 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 57.0 KW 18.8 KVAR 60.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 987 FEEDER AMPS: 5 VOLTAGE DROP: 16. %VD: .2
PROJECTED POWER FLOW: 57.0 KW 18.8 KVAR 60.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 987 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7151 %VD: .7
===== PU BUS VOLTAGE: .993 ANGLE: -.8 DEGREES

LOAD FROM: 985 9-34 PRI FEEDER AMPS: 5 VOLTAGE DROP: 16. %VD: .2
PROJECTED POWER FLOW: 56.8 KW 18.7 KVAR 59.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

LOAD TO: 990 9-26 PRI FEEDER AMPS: 3 VOLTAGE DROP: 15. %VD: .2
PROJECTED POWER FLOW: 33.3 KW 11.0 KVAR 35.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 992 FEEDER AMPS: 2 VOLTAGE DROP: 28. %VD: .4
PROJECTED POWER FLOW: 23.5 KW 7.8 KVAR 24.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 990 9-26 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7136 %VD: .9
===== PU BUS VOLTAGE: .991 ANGLE: -.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 33.2 KW 10.9 KVAR

LOAD FROM: 987 FEEDER AMPS: 3 VOLTAGE DROP: 15. %VD: .2
PROJECTED POWER FLOW: 33.2 KW 10.9 KVAR 35.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

==== BUS: 992 DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7123 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -.8 DEGREES

LOAD FROM: 987 FEEDER AMPS: 2 VOLTAGE DROP: 28. %VD: .4
PROJECTED POWER FLOW: 23.4 KW 7.7 KVAR 24.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 997 9-32 PRI FEEDER AMPS: 2 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 23.4 KW 7.7 KVAR 24.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 997 9-32 PRI DESIGN VOLTAGE: 7200 BUS VOLTAGE: 7117 %VD: 1.1
===== PU BUS VOLTAGE: .989 ANGLE: -.8 DEGREES
PROJECTED SPECIAL BUS LOAD: 23.4 KW 7.7 KVAR

LOAD FROM: 992 FEEDER AMPS: 2 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 23.4 KW 7.7 KVAR 24.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.046	20	GEN G2	2400.00	1.046
30	GEN G3	2400.00	1.046	40	GEN G4	2400.00	1.046
50	GEN G5	2400.00	1.046	60	SWGR S	2400.00	1.046
62	SS-1 SEC	480.00	1.046	64	MCC 4&5	480.00	1.046
66	SM1A BLUE	2400.00	1.046	68	BLUE SSS	480.00	1.046
70	SWGR N	2400.00	1.046	80	UTILITY	24900.00	1.000
85	T1 SEC	2400.00	1.046	90	SWGR O	2400.00	1.046
100	FDR 1	2400.00	1.045	105	F1F12 14	2400.00	1.040
110	F1 L14	2400.00	1.039	115	F1 L15	2400.00	1.039
120	F1 L31	2400.00	1.038	121	F1 L63	2400.00	1.036
122	F1 L64	2400.00	1.036	200	FDR 2	2400.00	1.045
205		2400.00	1.042	235	F5 F29	2400.00	1.040
236	F2 F211	2400.00	1.039	240	F1 F213	2400.00	1.039
300	FDR 3	2400.00	1.046	400	FDR 4	2400.00	1.046
500	FDR 5	2400.00	1.046	505	F4 F5 F6UF	2400.00	1.045
512	5-3 PRI	2400.00	1.043	515	F5 L24	2400.00	1.042
525	F5 L31	2400.00	1.041	531	F3 L41	2400.00	1.041
535	F537 L5	2400.00	1.041	555		2400.00	1.040
560	RICH SUB	2400.00	1.037	562	RS SEC	7200.00	1.036
565	5-17 PRI	2400.00	1.039	575	F5 51	2400.00	1.039
580	F5 L85	2400.00	1.039	600	O/H BUS	2400.00	1.046
700	FDR 7	2400.00	1.045	705	WELL9 POL	2400.00	1.045
707	7-1 SEC	480.00	1.045	709	F9 F73	2400.00	1.044
710	F7 L11	2400.00	1.043	715	F7 L13	2400.00	1.042
720	F713	2400.00	1.042	725	7-15 PRI	2400.00	1.042
735	F7 L54	2400.00	1.041	745		2400.00	1.041
750	F7 L72	2400.00	1.041	800	FDR 8	2400.00	1.046
900	FDR 9	2400.00	1.045	905	STEP SEC	7200.00	1.041
910	F 96	7200.00	1.041	915	F910	7200.00	1.040
920	F940	7200.00	1.038	925	()	7200.00	1.035
930	RICH SUB	7200.00	1.036	935	9-8 PRI	7200.00	1.035
940	9-9 PRI	7200.00	1.034	945	F949 L1	7200.00	1.037
960	9-13 PRI	7200.00	1.034	963	9-14 PRI	7200.00	1.023
966	9-15 PRI	7200.00	1.020	969	SW UP	7200.00	1.020
972	SW DOWN	7200.00	1.020	975	9-16 PRI	7200.00	1.009
980		7200.00	1.004	983	9-25 PRI	7200.00	.996
984	9-25 SEC	208.00	.996	985	9-34 PRI	7200.00	.995
987		7200.00	.993	990	9-26 PRI	7200.00	.991
992		7200.00	.989	997	9-32 PRI	7200.00	.989

DATE: 27 NOV 95 TIME: 9 10 AM PAGE 39
CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	60	SWGR S	FDR	.02	230.03	1000.00	49.47
20	GEN G2	60	SWGR S	FDR	.00	.00	.00	.00
30	GEN G3	60	SWGR S	FDR	.00	.00	.00	.00
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	10	GEN G1	FDR	.02	230.03	999.76	49.47
60	SWGR S	20	GEN G2	FDR	.00	.00	.00	.00
60	SWGR S	30	GEN G3	FDR	.00	.00	.00	.00
60	SWGR S	62	SS-1 SEC	TX2	.00	.05	.20	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.07	.31	.02
60	SWGR S	70	SWGR N	FDR	.00	128.92	560.31	27.72
60	SWGR S	100	FDR 1	FDR	.02	41.71	181.27	18.13
60	SWGR S	200	FDR 2	FDR	.02	57.87	251.50	25.16
60	SWGR S	300	FDR 3	FDR	.00	.00	.00	.00
60	SWGR S	400	FDR 4	FDR	.00	.00	.00	.00
60	SWGR S	500	FDR 5	FDR	.01	12.40	53.89	5.39
62	SS-1 SEC	60	SWGR S	TX2	.00	.23	.20	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.23	.20	.05
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.23	.20	.05
64	MCC 4&5	68	BLUE SSS	FDR	.00	.35	.31	.08
64	MCC 4&5	90	SWGR O	TX2	.00	.59	.51	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.07	.31	.02
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.07	.31	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.35	.31	.08
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.35	.31	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	128.92	560.31	27.72
70	SWGR N	90	SWGR O	FDR	.00	128.92	560.31	34.84
80	UTILITY	85	T1 SEC	TX2	4.55	7.55	325.76	UNKNOW
85	T1 SEC	80	UTILITY	TX2	4.55	74.45	323.57	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.00	74.45	323.57	20.12
90	SWGR O	64	MCC 4&5	TX2	.00	.12	.51	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	128.92	560.29	34.84
90	SWGR O	85	T1 SEC	FDR	.00	74.45	323.56	20.12
90	SWGR O	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR O	700	FDR 7	FDR	.02	51.55	224.03	22.41
90	SWGR O	800	FDR 8	FDR	.00	.00	.00	.00
90	SWGR O	900	FDR 9	FDR	.03	64.43	280.02	28.01
100	FDR 1	60	SWGR S	FDR	.02	41.71	181.24	18.13

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
100	FDR 1	105	F1F12 14	FDR	.56	41.71	181.24	11.68
105	F1F12 14	100	FDR 1	FDR	.56	41.71	180.28	11.68
105	F1F12 14	110	F1 L14	FDR	.07	41.71	180.28	11.68
110	F1 L14	105	F1F12 14	FDR	.07	41.71	180.15	11.68
110	F1 L14	115	F1 L15	FDR	.00	.00	.00	.00
110	F1 L14	120	F1 L31	FDR	.15	41.71	180.15	11.68
115	F1 L15	110	F1 L14	FDR	.00	.00	.00	.00
120	F1 L31	110	F1 L14	FDR	.15	41.71	179.89	11.68
120	F1 L31	121	F1 L63	FDR	.12	30.52	131.64	8.55
121	F1 L63	120	F1 L31	FDR	.12	30.52	131.49	8.55
121	F1 L63	122	F1 L64	FDR	.03	19.35	83.34	5.42
122	F1 L64	121	F1 L63	FDR	.03	19.35	83.32	5.42
200	FDR 2	60	SWGR S	FDR	.02	57.87	251.44	25.16
200	FDR 2	205	FDR 2	FDR	.31	57.87	251.44	16.21
205		200	FDR 2	FDR	.31	57.87	250.70	16.21
205		235	F5 F29	FDR	.21	57.87	250.70	16.21
235	F5 F29	205		FDR	.21	57.87	250.21	16.21
235	F5 F29	236	F2 F211	FDR	.10	46.31	200.25	12.97
236	F2 F211	235	F5 F29	FDR	.10	46.31	200.05	12.97
236	F2 F211	240	F1 F213	FDR	.05	23.15	100.00	6.48
240	F1 F213	236	F2 F211	FDR	.05	23.15	99.95	6.48
300	FDR 3	60	SWGR S	FDR	.00	.00	.00	.00
400	FDR 4	60	SWGR S	FDR	.00	.00	.00	.00
500	FDR 5	60	SWGR S	FDR	.01	12.40	53.89	5.39
500	FDR 5	505	F4 F5 F6UF	FDR	.07	12.40	53.89	3.47
505	F4 F5 F6UF	500	FDR 5	FDR	.07	12.40	53.85	3.47
505	F4 F5 F6UF	512	5-3 PRI	FDR	.18	12.40	53.85	3.47
512	5-3 PRI	505	F4 F5 F6UF	FDR	.18	12.40	53.76	3.47
512	5-3 PRI	515	F5 L24	FDR	.14	12.40	53.76	3.47
515	F5 L24	512	5-3 PRI	FDR	.14	12.40	53.69	3.47
515	F5 L24	525	F5 L31	FDR	.02	12.40	53.69	3.47
525	F5 L31	515	F5 L24	FDR	.02	12.40	53.68	3.47
525	F5 L31	531	F3 L41	FDR	.02	5.12	22.15	1.43
525	F5 L31	535	F537 L5	FDR	.06	5.12	22.15	1.43
531	F3 L41	525	F5 L31	FDR	.02	5.12	22.15	1.43
531	F3 L41	535	F537 L5	FDR	.04	5.12	22.15	1.43
535	F537 L5	525	F5 L31	FDR	.06	5.12	22.14	1.43
535	F537 L5	531	F3 L41	FDR	.04	5.12	22.14	1.43
535	F537 L5	555		FDR	.10	10.23	44.28	3.71
555		535	F537 L5	FDR	.10	10.23	44.24	3.71

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
555		560	RICH SUB	FDR	.27	6.73	29.11	2.44
555		565	5-17 PRI	FDR	.04	3.50	15.15	1.27
560	RICH SUB	555		FDR	.27	6.73	29.03	2.44
560	RICH SUB	562	RS SEC	TX2	.12	6.73	29.03	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	2.24	29.00	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	2.24	29.00	1.60
565	5-17 PRI	555		FDR	.04	3.50	15.14	1.27
565	5-17 PRI	575	F5 51	FDR	.01	2.16	9.34	.78
575	F5 51	565	5-17 PRI	FDR	.01	2.16	9.34	.78
575	F5 51	580	F5 L85	FDR	.02	2.16	9.34	.78
580	F5 L85	575	F5 51	FDR	.02	2.16	9.34	.78
600	O/H BUS	90	SWGR O	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR O	FDR	.02	51.55	223.99	22.41
700	FDR 7	705	WELL9 POL	FDR	.02	51.55	223.99	14.44
705	WELL9 POL	700	FDR 7	FDR	.02	51.55	223.94	14.44
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.07	40.66	176.62	11.39
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.07	40.66	176.50	11.39
709	F9 F73	710	F7 L11	FDR	.17	18.73	81.31	5.25
710	F7 L11	709	F9 F73	FDR	.17	18.73	81.18	5.25
710	F7 L11	715	F7 L13	FDR	.02	5.55	24.06	1.55
710	F7 L11	720	F713	FDR	.03	7.72	33.47	2.16
715	F7 L13	710	F7 L11	FDR	.02	5.55	24.05	1.55
720	F713	710	F7 L11	FDR	.03	7.72	33.46	2.16
720	F713	725	7-15 PRI	FDR	.08	7.72	33.46	2.16
725	7-15 PRI	720	F713	FDR	.08	7.72	33.44	2.16
725	7-15 PRI	735	F7 L54	FDR	.02	7.72	33.44	2.16
735	F7 L54	725	7-15 PRI	FDR	.02	7.72	33.43	2.16
735	F7 L54	745		FDR	.03	5.54	23.99	1.55
745		735	F7 L54	FDR	.03	5.54	23.98	1.55
745		750	F7 L72	FDR	.03	5.54	23.98	1.55
750	F7 L72	745		FDR	.03	5.54	23.98	1.55
800	FDR 8	90	SWGR O	FDR	.00	.00	.00	.00
900	FDR 9	90	SWGR O	FDR	.03	64.43	279.95	28.01
900	FDR 9	905	STEP SEC	TX2	.39	64.43	279.95	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.39	21.48	278.90	UNKNOW
905	STEP SEC	910	F 96	FDR	.04	21.48	278.90	6.02
910	F 96	905	STEP SEC	FDR	.04	21.48	278.80	6.02
910	F 96	915	F910	FDR	.05	19.91	258.48	5.58

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
915	F910	910	F 96	FDR	.05	19.91	258.37	5.58
915	F910	920	F940	FDR	.27	19.91	258.37	5.58
920	F940	915	F910	FDR	.27	19.91	257.70	5.58
920	F940	945	F949 L1	FDR	.05	19.91	257.70	5.58
925	()	930	RICH SUB	FDR	.04	2.24	28.99	1.60
925	()	935	9-8 PRI	FDR	.04	2.24	28.99	2.14
930	RICH SUB	562	RS SEC	FDR	.00	2.24	29.00	1.60
930	RICH SUB	925	()	FDR	.04	2.24	29.00	1.60
935	9-8 PRI	925	()	FDR	.04	2.24	28.98	2.14
935	9-8 PRI	940	9-9 PRI	FDR	.11	1.35	17.38	1.28
940	9-9 PRI	935	9-8 PRI	FDR	.11	1.35	17.36	1.28
945	F949 L1	920	F940	FDR	.05	19.91	257.59	5.58
945	F949 L1	960	9-13 PRI	FDR	.31	19.53	252.65	10.61
960	9-13 PRI	945	F949 L1	FDR	.31	19.53	251.89	10.61
960	9-13 PRI	963	9-14 PRI	FDR	1.08	19.53	251.89	10.61
963	9-14 PRI	960	9-13 PRI	FDR	1.08	19.53	249.25	10.61
963	9-14 PRI	966	9-15 PRI	FDR	.29	17.99	229.61	9.78
966	9-15 PRI	963	9-14 PRI	FDR	.29	17.99	228.96	9.78
966	9-15 PRI	969	SW UP	FDR	.08	17.99	228.96	9.78
969	SW UP	966	9-15 PRI	FDR	.08	17.99	228.79	9.78
969	SW UP	972	SW DOWN	FDR	.00	17.99	228.79	3.87
972	SW DOWN	969	SW UP	FDR	.00	17.99	228.79	3.87
972	SW DOWN	975	9-16 PRI	FDR	1.10	17.99	228.79	9.78
975	9-16 PRI	972	SW DOWN	FDR	1.10	17.99	226.31	9.78
975	9-16 PRI	980		FDR	.46	17.99	226.31	9.78
980		975	9-16 PRI	FDR	.46	17.99	225.28	9.78
980		983	9-25 PRI	FDR	.79	17.99	225.28	9.78
983	9-25 PRI	980		FDR	.79	17.99	223.51	9.78
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.07	4.83	60.03	2.63
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.07	4.83	59.98	2.63
985	9-34 PRI	987		FDR	.23	4.83	59.98	2.63
987		985	9-34 PRI	FDR	.23	4.83	59.85	2.63
987		990	9-26 PRI	FDR	.20	2.83	35.07	1.54
987		992		FDR	.39	2.00	24.78	1.09
990	9-26 PRI	987		FDR	.20	2.83	34.99	1.54
992		987		FDR	.39	2.00	24.68	1.09
992		997	9-32 PRI	FDR	.07	2.00	24.68	1.09
997	9-32 PRI	992		FDR	.07	2.00	24.67	1.09

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CASE 3 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING EXISTING SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

78 BUSES

*** T O T A L S Y S T E M L O S S E S ***
13.6 KW 13.9 KVAR

WARNING STUDY CONTAINS 2 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY (\$) AT BUS AND BRANCH %VD LOCATIONS



APPENDIX I

Load Flow Analysis - Case 4

CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

DATE: 27 NOV 95
TIME: 9 12 AM

ALL INFORMATION PRESENTED IS FOR REVIEW, APPROVAL
INTERPRETATION AND APPLICATION BY A REGISTERED
ENGINEER ONLY

DAPPER (LOAD FLOW AND VOLTAGE DROP MINI/MICRO VERSION 4.5 LEVEL 1.0)
COPYRIGHT SKM SYSTEMS ANALYSIS, INC. 1983

DATE:27 NOV 95 TIME: 9 12 AM PAGE 2
CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

SWING GENERATORS

BUS NO	ID	STAT	VOLTAGE	ANGLE
80	6	1	1.000	.000

PV GENERATORS

BUS NO	ID	STAT	VOLTAGE	kW	KVARMIN	KVARMAX	PARTICIPATION
10	1	1	1.000	1000.	0.	0.	1.000
20	2	1	1.000	0.	0.	0.	1.000
30	3	1	1.000	0.	0.	0.	1.000
40	4	1	1.000	0.	0.	0.	1.000
50	5	1	1.000	0.	0.	0.	1.000
NOTICE: BRANCH	725	7-15	PRI	TO 730	F7 L43	IS OUT OF SERVICE	
NOTICE: BRANCH	735	F7 L54		TO 740	7-17 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	750	F7 L72		TO 755	F7-33	IS OUT OF SERVICE	
NOTICE: BRANCH	745			TO 760	7-21 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	760	7-21	PRI	TO 765	7-22 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	765	7-22	PRI	TO 770	7-23 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	770	7-23	PRI	TO 775	7-24 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	800	FDR 8		TO 805	F8 L11	IS OUT OF SERVICE	
NOTICE: BRANCH	805	F8 L11		TO 810	F8 L23	IS OUT OF SERVICE	
NOTICE: BRANCH	810	F8 L23		TO 815	F8 L25	IS OUT OF SERVICE	
NOTICE: BRANCH	810	F8 L23		TO 817	F8 22	IS OUT OF SERVICE	
NOTICE: BRANCH	820	F8 30	UF1	TO 825	8-22 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	920	F940		TO 925	()	IS OUT OF SERVICE	
NOTICE: BRANCH	945	F949 L1		TO 950	9-12 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	950	9-12	PRI	TO 955	9-11 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	975	9-16	PRI	TO 977	9-19 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	980			TO 982	9-20 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	992			TO 995	9-30 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	121	F1 L63		TO 125	F1 L67	IS OUT OF SERVICE	
NOTICE: BRANCH	125	F1 L67		TO 130	F1 L613	IS OUT OF SERVICE	
NOTICE: BRANCH	125	F1 L67		TO 135	F1 L68	IS OUT OF SERVICE	
NOTICE: BRANCH	205			TO 210	2-3 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	400	FDR 4		TO 401	4-1 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	305	F8 F311		TO 310	F3 19	IS OUT OF SERVICE	
NOTICE: BRANCH	405	F4 10		TO 410	F417 UF1	IS OUT OF SERVICE	
NOTICE: BRANCH	505	F4 F5 F6UF		TO 510	5-1 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	515	F5 L24		TO 520	5-6 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	525	F5 L31		TO 530	F5 L39	IS OUT OF SERVICE	
NOTICE: BRANCH	535	F537 L5		TO 540	F5 L5 UF1	IS OUT OF SERVICE	
NOTICE: BRANCH	540	F5 L5 UF1		TO 545	F5 L56 UF1	IS OUT OF SERVICE	
NOTICE: BRANCH	540	F5 L5 UF1		TO 550	F5 L55	IS OUT OF SERVICE	
NOTICE: BRANCH	565	5-17	PRI	TO 570	5-18 PRI	IS OUT OF SERVICE	
NOTICE: BRANCH	580	F5 L85		TO 585	F5 L87 UF1	IS OUT OF SERVICE	
NOTICE: BRANCH	580	F5 L85		TO 590	F5 L8911	IS OUT OF SERVICE	
NOTICE: BRANCH	590	F5 L8911		TO 595	F5 L8 25	IS OUT OF SERVICE	

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

NOTICE: BRANCH	303 F713	TO	305 F8 F311	IS OUT OF SERVICE
NOTICE: BRANCH	817 F8 22	TO	820 F8 30 UF1	IS OUT OF SERVICE
NOTICE: BRANCH	210 2-3 PRI	TO	215 2-4 PRI	IS OUT OF SERVICE
NOTICE: BRANCH	215 2-4 PRI	TO	220 2-5 PRI	IS OUT OF SERVICE
NOTICE: BRANCH	512 5-3 PRI	TO	514 5-5 PRI	IS OUT OF SERVICE
NOTICE: BRANCH	210 2-3 PRI	TO	225 2-3 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	215 2-4 PRI	TO	230 2-4 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	410 F417 UF1	TO	415 4-6 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	545 F5 L56 UF1	TO	547 5-16 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	590 F5 L8911	TO	591 5-23 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	590 F5 L8911	TO	593 5-24 SEC	IS OUT OF SERVICE
NOTICE: BRANCH	300 FDR 3	TO	301 F8 F311	IS OUT OF SERVICE
NOTICE: BRANCH	301 F8 F311	TO	303 F713	IS OUT OF SERVICE
NOTICE: BRANCH	401 4-1 PRI	TO	403 F1 F45	IS OUT OF SERVICE
NOTICE: BRANCH	403 F1 F45	TO	405 F4 10	IS OUT OF SERVICE

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
10 GEN G1 IMPEDANCE:	15 G1 STEP-UP .0300 + J	1 .0526 OHMS/M	2400. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
20 GEN G2 IMPEDANCE:	25 G2 STEP-UP .0300 + J	1 .0526 OHMS/M	2400. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
30 GEN G3 IMPEDANCE:	35 G3 STEP-UP .0300 + J	1 .0526 OHMS/M	2400. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
40 GEN G4 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M	4160. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
50 GEN G5 IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M	4160. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	66 SM1A BLUE .0300 + J	1 .0526 OHMS/M	4160. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	70 SWGR N .0300 + J	1 .0526 OHMS/M	4160. FEET	5. FT	500	C	M	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	100 FDR 1 .1050 + J	1 .0410 OHMS/M	4160. FEET	50. FT	4/0	A	N	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	200 FDR 2 .1050 + J	1 .0410 OHMS/M	4160. FEET	50. FT	4/0	A	N	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	300 FDR 3 .1050 + J	1 .0410 OHMS/M	4160. FEET	50. FT	4/0	A	N	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	400 FDR 4 .1050 + J	1 .0410 OHMS/M	4160. FEET	50. FT	4/0	A	N	XLP STATUS: EXISTING
60 SWGR S IMPEDANCE:	500 FDR 5 .1050 + J	1 .0410 OHMS/M	4160. FEET	50. FT	4/0	A	N	XLP STATUS: EXISTING
62 SS-1 SEC IMPEDANCE:	64 MCC 4&5 .0300 + J	1 .0526 OHMS/M	480. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
64 MCC 4&5 IMPEDANCE:	68 BLUE SSS .0300 + J	1 .0526 OHMS/M	480. FEET	50. FT	500	C	M	XLP STATUS: EXISTING
70 SWGR N IMPEDANCE:	90 SWGR O .0453 + J	1 .0444 OHMS/M	4160. FEET	10. FT	500	A	M	XLP STATUS: EXISTING

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
85 T1 SEC IMPEDANCE:	90 SWGR O .0453 + J	1 .0444	4160. OHMS/M FEET	10. FT	500	A M XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	600 O/H BUS .1050 + J	1 .0410	4160. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	700 FDR 7 .1050 + J	1 .0410	4160. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	800 FDR 8 .1050 + J	1 .0410	4160. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
90 SWGR O IMPEDANCE:	900 FDR 9 .1050 + J	1 .0410	4160. OHMS/M FEET	50. FT	4/0	A N XLP STATUS: EXISTING
100 FDR 1 IMPEDANCE:	105 F1F12 14 .0900 + J	1 .1200	4160. OHMS/M FEET	1500. FT	4/0	A B OH-2 STATUS: EXISTING
105 F1F12 14 IMPEDANCE:	110 F1 L14 .0900 + J	1 .1200	4160. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	115 F1 L15 .0900 + J	1 .1200	4160. OHMS/M FEET	300. FT	4/0	A B OH-2 STATUS: EXISTING
110 F1 L14 IMPEDANCE:	120 F1 L31 .0900 + J	1 .1200	4160. OHMS/M FEET	400. FT	4/0	A B OH-2 STATUS: EXISTING
120 F1 L31 IMPEDANCE:	121 F1 L63 .0900 + J	1 .1200	4160. OHMS/M FEET	450. FT	4/0	A B OH-2 STATUS: EXISTING
121 F1 L63 IMPEDANCE:	122 F1 L64 .0900 + J	1 .1200	4160. OHMS/M FEET	200. FT	4/0	A B OH-2 STATUS: EXISTING
200 FDR 2 IMPEDANCE:	205 .0900 + J	1 .1200	4160. OHMS/M FEET	600. FT	4/0	A B OH-2 STATUS: EXISTING
205 IMPEDANCE:	235 F5 F29 .0900 + J	1 .1200	4160. OHMS/M FEET	400. FT	4/0	A B OH-2 STATUS: EXISTING
235 F5 F29 IMPEDANCE:	236 F2 F211 .0900 + J	1 .1200	4160. OHMS/M FEET	250. FT	4/0	A B OH-2 STATUS: EXISTING
236 F2 F211 IMPEDANCE:	240 F1 F213 .0900 + J	1 .1200	4160. OHMS/M FEET	250. FT	4/0	A B OH-2 STATUS: EXISTING

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE	DUCT	INSUL
500 FDR 5 IMPEDANCE:	505 F4 F5 F6UF .0900 + J	1 .1200 OHMS/M FEET	4160.	625. FT	4/0	A B	OH-2	STATUS: EXISTING
505 F4 F5 F6UF IMPEDANCE:	512 5-3 PRI .0900 + J	1 .1200 OHMS/M FEET	4160.	1600. FT	4/0	A B	OH-2	STATUS: EXISTING
512 5-3 PRI IMPEDANCE:	515 F5 L24 .0900 + J	1 .1200 OHMS/M FEET	4160.	1200. FT	4/0	A B	OH-2	STATUS: EXISTING
515 F5 L24 IMPEDANCE:	525 F5 L31 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B	OH-2	STATUS: EXISTING
525 F5 L31 IMPEDANCE:	531 F3 L41 .0900 + J	1 .1200 OHMS/M FEET	4160.	500. FT	4/0	A B	OH-2	STATUS: EXISTING
525 F5 L31 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200 OHMS/M FEET	4160.	1400. FT	4/0	A B	OH-2	STATUS: EXISTING
531 F3 L41 IMPEDANCE:	535 F537 L5 .0900 + J	1 .1200 OHMS/M FEET	4160.	900. FT	4/0	A B	OH-2	STATUS: EXISTING
535 F537 L5 IMPEDANCE:	555 .1410 + J	1 .1250 OHMS/M FEET	4160.	800. FT	2/0	A B	OH-2	STATUS: EXISTING
555 IMPEDANCE:	560 RICH SUB .1410 + J	1 .1250 OHMS/M FEET	4160.	3200. FT	2/0	A B	OH-2	STATUS: EXISTING
555 IMPEDANCE:	565 5-17 PRI .1410 + J	1 .1250 OHMS/M FEET	4160.	800. FT	2/0	A B	OH-2	STATUS: EXISTING
562 RS SEC IMPEDANCE:	930 RICH SUB .4360 + J	1 .1380 OHMS/M FEET	13200.	5. FT	4	A B	OH-3	STATUS: EXISTING
565 5-17 PRI IMPEDANCE:	575 F5 51 .1410 + J	1 .1250 OHMS/M FEET	4160.	300. FT	2/0	A B	OH-2	STATUS: EXISTING
575 F5 51 IMPEDANCE:	580 F5 L85 .1410 + J	1 .1250 OHMS/M FEET	4160.	600. FT	2/0	A B	OH-2	STATUS: EXISTING
700 FDR 7 IMPEDANCE:	705 WELL9 POL .0900 + J	1 .1200 OHMS/M FEET	4160.	50. FT	4/0	A B	OH-2	STATUS: EXISTING
705 WELL9 POL IMPEDANCE:	709 F9 F73 .0900 + J	1 .1200 OHMS/M FEET	4160.	200. FT	4/0	A B	OH-2	STATUS: EXISTING

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

FEEDER DATA

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	DESCRIPTION TYPE DUCT INSUL
709 F9 F73 IMPEDANCE: .0900 + J	710 F7 L11 .1200 OHMS/M FEET	1	4160.	1000. FT	4/0	A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE: .0900 + J	715 F7 L13 .1200 OHMS/M FEET	1	4160.	500. FT	4/0	A B OH-2 STATUS: EXISTING
710 F7 L11 IMPEDANCE: .0900 + J	720 F713 .1200 OHMS/M FEET	1	4160.	500. FT	4/0	A B OH-2 STATUS: EXISTING
720 F713 IMPEDANCE: .0900 + J	725 7-15 PRI .1200 OHMS/M FEET	1	4160.	1200. FT	4/0	A B OH-2 STATUS: EXISTING
725 7-15 PRI IMPEDANCE: .0900 + J	735 F7 L54 .1200 OHMS/M FEET	1	4160.	350. FT	4/0	A B OH-2 STATUS: EXISTING
735 F7 L54 IMPEDANCE: .0900 + J	745 .1200 OHMS/M FEET	1	4160.	625. FT	4/0	A B OH-2 STATUS: EXISTING
745 IMPEDANCE: .0900 + J	750 F7 L72 .1200 OHMS/M FEET	1	4160.	525. FT	4/0	A B OH-2 STATUS: EXISTING
905 STEP SEC IMPEDANCE: .0900 + J	910 F 96 .1200 OHMS/M FEET	1	13200.	600. FT	4/0	A B OH-3 STATUS: EXISTING
910 F 96 IMPEDANCE: .0900 + J	915 F910 .1200 OHMS/M FEET	1	13200.	800. FT	4/0	A B OH-3 STATUS: EXISTING
915 F910 IMPEDANCE: .0900 + J	920 F940 .1200 OHMS/M FEET	1	13200.	4500. FT	4/0	A B OH-3 STATUS: EXISTING
920 F940 IMPEDANCE: .0900 + J	945 F949 L1 .1200 OHMS/M FEET	1	13200.	800. FT	4/0	A B OH-3 STATUS: EXISTING
925 () IMPEDANCE: .4360 + J	930 RICH SUB .1380 OHMS/M FEET	1	13200.	1500. FT	4	A B OH-3 STATUS: EXISTING
925 () IMPEDANCE: .6900 + J	935 9-8 PRI .1440 OHMS/M FEET	1	13200.	1000. FT	6	A B OH-3 STATUS: EXISTING
935 9-8 PRI IMPEDANCE: .6900 + J	940 9-9 PRI .1440 OHMS/M FEET	1	13200.	5000. FT	6	A B OH-3 STATUS: EXISTING
945 F949 L1 IMPEDANCE: .2760 + J	960 9-13 PRI .1320 OHMS/M FEET	1	13200.	2200. FT	2	A B OH-3 STATUS: EXISTING

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

F E E D E R D A T A

FEEDER FROM NO NAME	FEEDER TO NO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER DESCRIPTION SIZE TYPE DUCT INSUL
960 9-13 PRI IMPEDANCE:	963 9-14 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	7600. FT 2	A B OH-3 STATUS: EXISTING
963 9-14 PRI IMPEDANCE:	966 9-15 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	2200. FT 2	A B OH-3 STATUS: EXISTING
966 9-15 PRI IMPEDANCE:	969 SW UP .2760 + J	1 .1320 OHMS/M FEET	13200.	600. FT 2	A B OH-3 STATUS: EXISTING
969 SW UP IMPEDANCE:	972 SW DOWN .0300 + J	1 .0526 OHMS/M FEET	13200.	5. FT 500	C M XLP STATUS: EXISTING
972 SW DOWN IMPEDANCE:	975 9-16 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	8400. FT 2	A B OH-3 STATUS: EXISTING
975 9-16 PRI IMPEDANCE:	980 .2760 + J	1 .1320 OHMS/M FEET	13200.	3500. FT 2	A B OH-3 STATUS: EXISTING
980 IMPEDANCE:	983 9-25 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	6000. FT 2	A B OH-3 STATUS: EXISTING
983 9-25 PRI IMPEDANCE:	985 9-34 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	2000. FT 2	A B OH-3 STATUS: EXISTING
985 9-34 PRI IMPEDANCE:	987 .2760 + J	1 .1320 OHMS/M FEET	13200.	6400. FT 2	A B OH-3 STATUS: EXISTING
987 IMPEDANCE:	990 9-26 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	9800. FT 2	A B OH-3 STATUS: EXISTING
987 IMPEDANCE:	992 .2760 + J	1 .1320 OHMS/M FEET	13200.	27000. FT 2	A B OH-3 STATUS: EXISTING
992 IMPEDANCE:	997 9-32 PRI .2760 + J	1 .1320 OHMS/M FEET	13200.	5000. FT 2	A B OH-3 STATUS: EXISTING

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T R A N S F O R M E R D A T A

PRIMARY RECORD NO NAME	VOLTS L-L	PRI FLA	* SECONDARY RECORD NO NAME	VOLTS L-L	SEC FLA	NOMINAL KVA
15 G1 STEP-UP IMPEDANCE:	2400. 1.0000 + J 5.6623	361. PERCENT	60 SWGR S	4160.	208.	1500.0
25 G2 STEP-UP IMPEDANCE:	2400. 1.0000 + J 5.6623	361. PERCENT	60 SWGR S	4160.	208.	1500.0
35 G3 STEP-UP IMPEDANCE:	2400. 1.0000 + J 5.6623	361. PERCENT	60 SWGR S	4160.	208.	1500.0
60 SWGR S IMPEDANCE:	4160. .7816 + J 4.5331	42. PERCENT	62 SS-1 SEC	480.	361.	300.0
66 SM1A BLUE IMPEDANCE:	4160. .8156 + J 4.7302	69. PERCENT	68 BLUE SSS	480.	601.	500.0
80 UTILITY IMPEDANCE:	24900. .5546 + J 5.9341	58. PERCENT	85 T1 SEC	4160.	347.	2500.0
			TRANSFORMER FIXED TAP:			-5.0 %
90 SWGR O IMPEDANCE:	4160. .5709 + J 3.3111	42. PERCENT	64 MCC 4&5	480.	361.	300.0
560 RICH SUB IMPEDANCE:	4160. .9345 + J 5.4200	83. PERCENT	562 RS SEC	13200.	26.	600.0
705 WELL9 POL IMPEDANCE:	4160. .9345 + J 5.4200	21. PERCENT	707 7-1 SEC	480.	180.	150.0
900 FDR 9 IMPEDANCE:	4160. .7816 + J 4.5331	208. PERCENT	905 STEP SEC	13200.	66.	1500.0
983 9-25 PRI IMPEDANCE:	13200. .9345 + J 5.4200	22. PERCENT	984 9-25 SEC	208.	1388.	500.0

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B U S S P E C I A L S T U D Y D A T A

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=====
* NO * NAME * KW * KVAR * LOAD TYPE
=====
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120	F1 L31	43.	14.	CONSTANT	Z	LOAD
121	F1 L63	43.	14.	CONSTANT	Z	LOAD
122	F1 L64	74.	24.	CONSTANT	Z	LOAD
235	F5 F29	44.	14.	CONSTANT	Z	LOAD
236	F2 F211	88.	29.	CONSTANT	Z	LOAD
240	F1 F213	88.	29.	CONSTANT	Z	LOAD
525	F5 L31	8.	3.	CONSTANT	Z	LOAD
565	5-17 PRI	5.	2.	CONSTANT	Z	LOAD
580	F5 L85	8.	3.	CONSTANT	Z	LOAD
705	WELL9 POL	41.	14.	CONSTANT	Z	LOAD
709	F9 F73	83.	27.	CONSTANT	Z	LOAD
710	F7 L11	21.	7.	CONSTANT	Z	LOAD
715	F7 L13	21.	7.	CONSTANT	Z	LOAD
735	F7 L54	8.	3.	CONSTANT	Z	LOAD
750	F7 L72	21.	7.	CONSTANT	Z	LOAD
910	F 96	18.	6.	CONSTANT	Z	LOAD
935	9-8 PRI	10.	3.	CONSTANT	Z	LOAD
940	9-9 PRI	15.	5.	CONSTANT	Z	LOAD
945	F949 L1	4.	1.	CONSTANT	Z	LOAD
960	9-13 PRI	18.	6.	CONSTANT	Z	LOAD
963	9-14 PRI	18.	6.	CONSTANT	Z	LOAD
983	9-25 PRI	157.	51.	CONSTANT	Z	LOAD
990	9-26 PRI	34.	11.	CONSTANT	Z	LOAD
997	9-32 PRI	24.	8.	CONSTANT	Z	LOAD

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*** SOLUTION COMMENTS ***
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SOLUTION PARAMETERS

BRANCH VOLTAGE CRITERIA : 4.00 %
BUS VOLTAGE CRITERIA : 5.00 %
ACCELERATION FACTOR FOR 'PV' GENERATORS : 1.00
ACCELERATION FACTOR FOR CONSTANT KVA LOADS: 1.00
EXACT(ITERATIVE) SOLUTION : YES

<<PERCENT VOLTAGE DROPS ARE BASED ON NOMINAL DESIGN VOLTAGES>>

TOF SIZE: 301

LARGEST LOAD:	1000.00 KVA	
CONVERGENCE CRITERIA:	.050 KVA	
LARGEST BUS MISMATCH	10 GEN G1	104.765 KVA
LARGEST BUS MISMATCH	10 GEN G1	5.926 KVA
LARGEST BUS MISMATCH	10 GEN G1	.336 KVA
LARGEST BUS MISMATCH	10 GEN G1	.019 KVA

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FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (SWING GENERATORS)

BUS	VOLTS(PU)	ANGLE	KW	KVAR	VD%	R + JX (PU)
80	1.000	.00	-26.7	361.2	.0	

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (PV GENERATOR SCHEDULE REPORT)

BUS NAME	ID	---VOLTAGE---		-KVAR LIMITS-		---ACTUAL----	
		SCHED.	ACTUAL	MIN	MAX	KW	KVAR
10 GEN G1	1	1.000	1.050	.0	.0	1000.0	.0
20 GEN G2	2	1.000	1.045	.0	.0	.0	.0
30 GEN G3	3	1.000	1.045	.0	.0	.0	.0
40 GEN G4	4	1.000	1.045	.0	.0	.0	.0
50 GEN G5	5	1.000	1.045	.0	.0	.0	.0

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 10 GEN G1 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2521 %VD: -5.0
===== PU BUS VOLTAGE: 1.050 ANGLE: 2.1 DEGREES
 ** PV TYPE GENERATOR: 1 1000.0 KW .0 KVAR

LOAD TO: 15 G1 STEP-UP FEEDER AMPS: 229 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 1000.0 KW .0 KVAR 1000.0 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

==== BUS: 15 G1 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2521 %VD: -5.0
===== PU BUS VOLTAGE: 1.050 ANGLE: 2.0 DEGREES

LOAD FROM: 10 GEN G1 FEEDER AMPS: 229 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 999.8 KW -.4 KVAR 999.8 KVA PF:1.00 UNITY
LOSSES THRU FEEDER: .2 KW .4 KVAR .5 KVA

LOAD TO: 60 SWGR S TRANSF AMPS: 229 VOLTAGE DROP: 14. %VD: .6
PROJECTED POWER FLOW: 999.8 KW -.4 KVAR 999.8 KVA PF:1.00 UNITY
LOSSES THRU TRANSF: 6.0 KW 34.2 KVAR 34.7 KVA

==== BUS: 20 GEN G2 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2507 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
 ** PV TYPE GENERATOR: 2 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

==== BUS: 25 G2 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2507 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

**** NO LOAD SPECIFIED ****

==== BUS: 30 GEN G3 DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2507 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
 ** PV TYPE GENERATOR: 3 .0 KW .0 KVAR

**** NO LOAD SPECIFIED ****

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 35 G3 STEP-UP DESIGN VOLTAGE: 2400 BUS VOLTAGE: 2507 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 40 GEN G4 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
 ** PV TYPE GENERATOR: 4 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 50 GEN G5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
 ** PV TYPE GENERATOR: 5 .0 KW .0 KVAR
**** NO LOAD SPECIFIED ****

==== BUS: 60 SWGR S DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 15 G1 STEP-UP TRANSF AMPS: 132 VOLTAGE DROP: 24. %VD: .6
PROJECTED POWER FLOW: 993.7 KW -34.6 KVAR 994.3 KVA PF:1.00 UNITY
LOSSES THRU TRANSF: 6.0 KW 34.2 KVAR 34.7 KVA

LOAD FROM: 25 G2 STEP-UP TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 35 G3 STEP-UP TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 62 SS-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .0 KVAR .1 KVA PF: .98 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 66 SM1A BLUE FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .1 KW .0 KVAR .1 KVA PF: .98 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 70 SWGR N FEEDER AMPS: 75 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 530.6 KW -189.1 KVAR 563.3 KVA PF: .94 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 100 FDR 1 FEEDER AMPS: 24 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 172.8 KW 57.2 KVAR 182.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 200 FDR 2 FEEDER AMPS: 33 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 239.4 KW 78.7 KVAR 252.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 300 FDR 3 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 400 FDR 4 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 500 FDR 5 FEEDER AMPS: 7 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 50.8 KW 18.6 KVAR 54.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 62 SS-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 501 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 64 MCC 4&5 DESIGN VOLTAGE: 480 BUS VOLTAGE: 501 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 66 SM1A BLUE DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 68 BLUE SSS DESIGN VOLTAGE: 480 BUS VOLTAGE: 501 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 70 SWGR N DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 40 GEN G4 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 50 GEN G5 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 60 SWGR S FEEDER AMPS: 75 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 530.6 KW -189.1 KVAR 563.3 KVA PF: .94 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 90 SWGR O FEEDER AMPS: 75 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 530.6 KW -189.1 KVAR 563.3 KVA PF: .94 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 80 UTILITY DESIGN VOLTAGE: 24900 BUS VOLTAGE: 24900 %VD: .0
===== PU BUS VOLTAGE: 1.000 ANGLE: .0 DEGREES
*** SWING GENERATOR: 6 -26.7 KW 361.2 KVAR

LOAD FROM: 85 T1 SEC TRANSF AMPS: 8 VOLTAGE DROP: 1109. %VD: 4.5\$
PROJECTED POWER FLOW: 26.7 KW -361.2 KVAR 362.2 KVA PF: .07 LEADING
LOSSES THRU TRANSF: .3 KW 2.8 KVAR 2.8 KVA **XFMR TAPS -5.0%**

==== BUS: 85 T1 SEC DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD TO: 80 UTILITY TRANSF AMPS: 48 VOLTAGE DROP: 185. %VD: 4.5\$
PROJECTED POWER FLOW: 27.0 KW -358.4 KVAR 359.4 KVA PF: .08 LEADING
LOSSES THRU TRANSF: .3 KW 2.8 KVAR 2.8 KVA **XFMR TAPS -5.0%**

LOAD FROM: 90 SWGR O FEEDER AMPS: 48 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.0 KW -358.4 KVAR 359.4 KVA PF: .08 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 90 SWGR 0 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 64 MCC 4&5 TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .2 KW .0 KVAR .2 KVA PF: .98 LAGGING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD FROM: 70 SWGR N FEEDER AMPS: 75 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 530.6 KW -189.1 KVAR 563.3 KVA PF: .94 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 85 T1 SEC FEEDER AMPS: 48 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.0 KW -358.4 KVAR 359.4 KVA PF: .08 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 600 O/H BUS FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 700 FDR 7 FEEDER AMPS: 30 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 212.5 KW 70.4 KVAR 223.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 800 FDR 8 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 900 FDR 9 FEEDER AMPS: 41 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 291.3 KW 98.9 KVAR 307.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 100 FDR 1 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 24 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 172.7 KW 57.2 KVAR 182.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 105 F1F12 14 FEEDER AMPS: 24 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 172.7 KW 57.2 KVAR 182.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 105 F1F12 14 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4337 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 100 FDR 1 FEEDER AMPS: 24 VOLTAGE DROP: 8. %VD: .2
PROJECTED POWER FLOW: 172.5 KW 56.8 KVAR 181.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .3 KVAR .4 KVA

LOAD TO: 110 F1 L14 FEEDER AMPS: 24 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 172.5 KW 56.8 KVAR 181.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 110 F1 L14 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4336 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 105 F1F12 14 FEEDER AMPS: 24 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 172.5 KW 56.8 KVAR 181.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 115 F1 L15 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 120 F1 L31 FEEDER AMPS: 24 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 172.5 KW 56.8 KVAR 181.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

==== BUS: 115 F1 L15 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4336 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 120 F1 L31 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4334 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 46.2 KW 15.2 KVAR

LOAD FROM: 110 F1 L14 FEEDER AMPS: 24 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 172.4 KW 56.7 KVAR 181.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .1 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 121 F1 L63 FEEDER AMPS: 18 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 126.2 KW 41.5 KVAR 132.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

==== BUS: 121 F1 L63 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4332 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 46.2 KW 15.2 KVAR

LOAD FROM: 120 F1 L31 FEEDER AMPS: 18 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 126.2 KW 41.5 KVAR 132.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 122 F1 L64 FEEDER AMPS: 11 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 80.0 KW 26.3 KVAR 84.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 122 F1 L64 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4332 %VD: -4.1
===== PU BUS VOLTAGE: 1.041 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 80.0 KW 26.3 KVAR

LOAD FROM: 121 F1 L63 FEEDER AMPS: 11 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 80.0 KW 26.3 KVAR 84.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 200 FDR 2 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 33 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 239.4 KW 78.7 KVAR 252.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 205 FEEDER AMPS: 33 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 239.4 KW 78.7 KVAR 252.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 205 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4341 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 200 FDR 2 FEEDER AMPS: 33 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 239.2 KW 78.5 KVAR 251.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 235 F5 F29 FEEDER AMPS: 33 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 239.2 KW 78.5 KVAR 251.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

==== BUS: 235 F5 F29 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4338 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 47.8 KW 15.2 KVAR

LOAD FROM: 205 FEEDER AMPS: 33 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 239.1 KW 78.3 KVAR 251.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .2 KVAR .2 KVA

LOAD TO: 236 F2 F211 FEEDER AMPS: 27 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 191.3 KW 63.1 KVAR 201.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

==== BUS: 236 F2 F211 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4336 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 95.6 KW 31.5 KVAR

LOAD FROM: 235 F5 F29 FEEDER AMPS: 27 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 191.2 KW 63.0 KVAR 201.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .1 KVAR .1 KVA

LOAD TO: 240 F1 F213 FEEDER AMPS: 13 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 95.6 KW 31.5 KVAR 100.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 240 F1 F213 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4336 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 95.6 KW 31.5 KVAR

LOAD FROM: 236 F2 F211 FEEDER AMPS: 13 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 95.6 KW 31.5 KVAR 100.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 300 FDR 3 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 400 FDR 4 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 500 FDR 5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES

LOAD FROM: 60 SWGR S FEEDER AMPS: 7 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 50.8 KW 18.6 KVAR 54.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 505 F4 F5 F6UF FEEDER AMPS: 7 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 50.8 KW 18.6 KVAR 54.1 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 505 F4 F5 F6UF DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4344 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES

LOAD FROM: 500 FDR 5 FEEDER AMPS: 7 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 50.7 KW 18.6 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 512 5-3 PRI FEEDER AMPS: 7 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 50.7 KW 18.6 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 512 5-3 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4342 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .0 DEGREES

LOAD FROM: 505 F4 F5 F6UF FEEDER AMPS: 7 VOLTAGE DROP: 3. %VD: .1
PROJECTED POWER FLOW: 50.7 KW 18.6 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 515 F5 L24 FEEDER AMPS: 7 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 50.7 KW 18.6 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 515 F5 L24 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4340 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 512 5-3 PRI FEEDER AMPS: 7 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 50.7 KW 18.5 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 525 F5 L31 FEEDER AMPS: 7 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 50.7 KW 18.5 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 525 F5 L31 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.7 KW 3.6 KVAR

LOAD FROM: 515 F5 L24 FEEDER AMPS: 7 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 50.7 KW 18.5 KVAR 54.0 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 531 F3 L41 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 3 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 531 F3 L41 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 525 F5 L31 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 535 F537 L5 FEEDER AMPS: 3 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 535 F537 L5 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 525 F5 L31 FEEDER AMPS: 3 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 531 F3 L41 FEEDER AMPS: 3 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 21.0 KW 7.5 KVAR 22.3 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 555 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 42.0 KW 14.9 KVAR 44.6 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 555 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4337 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 535 F537 L5 FEEDER AMPS: 6 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 42.0 KW 14.9 KVAR 44.6 KVA PF: .94 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 560 RICH SUB FEEDER AMPS: 4 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 27.9 KW 9.2 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 565 5-17 PRI FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 14.1 KW 5.7 KVAR 15.2 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 560 RICH SUB DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4333 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 555 FEEDER AMPS: 4 VOLTAGE DROP: 4. %VD: .1
PROJECTED POWER FLOW: 27.8 KW 9.2 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 562 RS SEC TRANSF AMPS: 4 VOLTAGE DROP: 5. %VD: .1
PROJECTED POWER FLOW: 27.8 KW 9.2 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

==== BUS: 562 RS SEC DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13734 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES

LOAD FROM: 560 RICH SUB TRANSF AMPS: 1 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .0 KW .1 KVAR .1 KVA

LOAD TO: 930 RICH SUB FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 565 5-17 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4337 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 5.4 KW 2.1 KVAR

LOAD FROM: 555 FEEDER AMPS: 2 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 14.1 KW 5.7 KVAR 15.2 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 575 F5 51 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.7 KW 3.6 KVAR 9.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 575 F5 51 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4337 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES

LOAD FROM: 565 5-17 PRI FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.7 KW 3.6 KVAR 9.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 580 F5 L85 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.7 KW 3.6 KVAR 9.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 580 F5 L85 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4336 %VD: -4.2
===== PU BUS VOLTAGE: 1.042 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 8.7 KW 3.6 KVAR

LOAD FROM: 575 F5 51 FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 8.7 KW 3.6 KVAR 9.4 KVA PF: .93 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 600 O/H BUS DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 700 FDR 7 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 30 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 212.5 KW 70.4 KVAR 223.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 705 WELL9 POL FEEDER AMPS: 30 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 212.5 KW 70.4 KVAR 223.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 705 WELL9 POL DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES
PROJECTED SPECIAL BUS LOAD: 44.7 KW 15.3 KVAR

LOAD FROM: 700 FDR 7 FEEDER AMPS: 30 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 212.5 KW 70.4 KVAR 223.8 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD FROM: 707 7-1 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 709 F9 F73 FEEDER AMPS: 23 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 167.8 KW 55.1 KVAR 176.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 707 7-1 SEC DESIGN VOLTAGE: 480 BUS VOLTAGE: 501 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 709 F9 F73 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4344 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES
PROJECTED SPECIAL BUS LOAD: 90.5 KW 29.4 KVAR

LOAD FROM: 705 WELL9 POL FEEDER AMPS: 23 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 167.7 KW 55.1 KVAR 176.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 710 F7 L11 FEEDER AMPS: 11 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 77.3 KW 25.7 KVAR 81.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 710 F7 L11 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4341 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.5 KW 7.4 KVAR

LOAD FROM: 709 F9 F73 FEEDER AMPS: 11 VOLTAGE DROP: 2. %VD: .1
PROJECTED POWER FLOW: 77.2 KW 25.6 KVAR 81.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 715 F7 L13 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.9 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 720 F713 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.9 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 715 F7 L13 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4341 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.9 KW 7.6 KVAR

LOAD FROM: 710 F7 L11 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.9 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 720 F713 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4341 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 710 F7 L11 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.9 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 725 7-15 PRI FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.9 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 725 7-15 PRI DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4340 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 720 F713 FEEDER AMPS: 4 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 735 F7 L54 FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 735 F7 L54 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 9.0 KW 3.0 KVAR

LOAD FROM: 725 7-15 PRI FEEDER AMPS: 4 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 31.8 KW 10.6 KVAR 33.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 745 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 745 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES

LOAD FROM: 735 F7 L54 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 750 F7 L72 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 750 F7 L72 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4339 %VD: -4.3
===== PU BUS VOLTAGE: 1.043 ANGLE: .0 DEGREES
PROJECTED SPECIAL BUS LOAD: 22.8 KW 7.6 KVAR

LOAD FROM: 745 FEEDER AMPS: 3 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 22.8 KW 7.6 KVAR 24.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 800 FDR 8 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.5
===== PU BUS VOLTAGE: 1.045 ANGLE: .1 DEGREES
**** NO LOAD SPECIFIED ****

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E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 900 FDR 9 DESIGN VOLTAGE: 4160 BUS VOLTAGE: 4345 %VD: -4.4
===== PU BUS VOLTAGE: 1.044 ANGLE: .1 DEGREES

LOAD FROM: 90 SWGR 0 FEEDER AMPS: 41 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 291.3 KW 98.9 KVAR 307.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 905 STEP SEC TRANSF AMPS: 41 VOLTAGE DROP: 18. %VD: .4
PROJECTED POWER FLOW: 291.3 KW 98.9 KVAR 307.6 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .5 KW 2.6 KVAR 2.7 KVA

==== BUS: 905 STEP SEC DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13730 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.4 DEGREES

LOAD FROM: 900 FDR 9 TRANSF AMPS: 13 VOLTAGE DROP: 57. %VD: .4
PROJECTED POWER FLOW: 290.8 KW 96.3 KVAR 306.3 KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .5 KW 2.6 KVAR 2.7 KVA

LOAD TO: 910 F 96 FEEDER AMPS: 13 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 290.8 KW 96.3 KVAR 306.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 910 F 96 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13728 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 19.3 KW 6.3 KVAR

LOAD FROM: 905 STEP SEC FEEDER AMPS: 13 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 290.8 KW 96.2 KVAR 306.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 915 F910 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 271.5 KW 89.9 KVAR 286.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 915 F910 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13726 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.4 DEGREES

LOAD FROM: 910 F 96 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 271.5 KW 89.8 KVAR 286.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 920 F940 FEEDER AMPS: 12 VOLTAGE DROP: 12. %VD: .1
PROJECTED POWER FLOW: 271.5 KW 89.8 KVAR 286.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

==== BUS: 920 F940 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13715 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.4 DEGREES

LOAD FROM: 915 F910 FEEDER AMPS: 12 VOLTAGE DROP: 12. %VD: .1
PROJECTED POWER FLOW: 271.3 KW 89.6 KVAR 285.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .2 KVAR .3 KVA

LOAD TO: 945 F949 L1 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 271.3 KW 89.6 KVAR 285.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

==== BUS: 925 () DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13733 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES

LOAD FROM: 930 RICH SUB FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 930 RICH SUB DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13734 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES

LOAD FROM: 562 RS SEC FEEDER AMPS: 1 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 925 () FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 935 9-8 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13731 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 11.1 KW 3.7 KVAR

LOAD FROM: 925 () FEEDER AMPS: 1 VOLTAGE DROP: 1. %VD: .0
PROJECTED POWER FLOW: 27.8 KW 9.1 KVAR 29.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 940 9-9 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 16.7 KW 5.5 KVAR 17.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 940 9-9 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13727 %VD: -4.0
===== PU BUS VOLTAGE: 1.040 ANGLE: -.1 DEGREES
PROJECTED SPECIAL BUS LOAD: 16.7 KW 5.5 KVAR

LOAD FROM: 935 9-8 PRI FEEDER AMPS: 1 VOLTAGE DROP: 4. %VD: .0
PROJECTED POWER FLOW: 16.7 KW 5.5 KVAR 17.6 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 945 F949 L1 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13712 %VD: -3.9
===== PU BUS VOLTAGE: 1.039 ANGLE: -.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 4.7 KW 1.5 KVAR

LOAD FROM: 920 F940 FEEDER AMPS: 12 VOLTAGE DROP: 2. %VD: .0
PROJECTED POWER FLOW: 271.3 KW 89.6 KVAR 285.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .1 KVA

LOAD TO: 960 9-13 PRI FEEDER AMPS: 12 VOLTAGE DROP: 14. %VD: .1
PROJECTED POWER FLOW: 266.6 KW 88.0 KVAR 280.7 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 960 9-13 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13699 %VD: -3.8
===== PU BUS VOLTAGE: 1.038 ANGLE: -.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 19.2 KW 6.3 KVAR

LOAD FROM: 945 F949 L1 FEEDER AMPS: 12 VOLTAGE DROP: 14. %VD: .1
PROJECTED POWER FLOW: 266.3 KW 87.9 KVAR 280.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

LOAD TO: 963 9-14 PRI FEEDER AMPS: 11 VOLTAGE DROP: 44. %VD: .3
PROJECTED POWER FLOW: 247.1 KW 81.6 KVAR 260.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .8 KW .4 KVAR .8 KVA

==== BUS: 963 9-14 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13655 %VD: -3.4
===== PU BUS VOLTAGE: 1.034 ANGLE: -.4 DEGREES
PROJECTED SPECIAL BUS LOAD: 19.1 KW 6.3 KVAR

LOAD FROM: 960 9-13 PRI FEEDER AMPS: 11 VOLTAGE DROP: 44. %VD: .3
PROJECTED POWER FLOW: 246.4 KW 81.2 KVAR 259.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .8 KW .4 KVAR .8 KVA

LOAD TO: 966 9-15 PRI FEEDER AMPS: 10 VOLTAGE DROP: 12. %VD: .1
PROJECTED POWER FLOW: 227.3 KW 75.0 KVAR 239.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

==== BUS: 966 9-15 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13643 %VD: -3.4
===== PU BUS VOLTAGE: 1.034 ANGLE: -.4 DEGREES

LOAD FROM: 963 9-14 PRI FEEDER AMPS: 10 VOLTAGE DROP: 12. %VD: .1
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .2 KW .1 KVAR .2 KVA

LOAD TO: 969 SW UP FEEDER AMPS: 10 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.2 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 969 SW UP DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13640 %VD: -3.3
===== PU BUS VOLTAGE: 1.033 ANGLE: -.5 DEGREES

LOAD FROM: 966 9-15 PRI FEEDER AMPS: 10 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .1 KW .0 KVAR .1 KVA

LOAD TO: 972 SW DOWN FEEDER AMPS: 10 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 972 SW DOWN DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13640 %VD: -3.3
===== PU BUS VOLTAGE: 1.033 ANGLE: -.5 DEGREES

LOAD FROM: 969 SW UP FEEDER AMPS: 10 VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 975 9-16 PRI FEEDER AMPS: 10 VOLTAGE DROP: 45. %VD: .3
PROJECTED POWER FLOW: 227.1 KW 74.9 KVAR 239.1 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .3 KVAR .8 KVA

==== BUS: 975 9-16 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13595 %VD: -3.0
===== PU BUS VOLTAGE: 1.030 ANGLE: -.5 DEGREES

LOAD FROM: 972 SW DOWN FEEDER AMPS: 10 VOLTAGE DROP: 45. %VD: .3
PROJECTED POWER FLOW: 226.4 KW 74.5 KVAR 238.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .7 KW .3 KVAR .8 KVA

LOAD TO: 980 FEEDER AMPS: 10 VOLTAGE DROP: 19. %VD: .1
PROJECTED POWER FLOW: 226.4 KW 74.5 KVAR 238.3 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

==== BUS: 980 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13577 %VD: -2.9
===== PU BUS VOLTAGE: 1.029 ANGLE: -.5 DEGREES

LOAD FROM: 975 9-16 PRI FEEDER AMPS: 10 VOLTAGE DROP: 19. %VD: .1
PROJECTED POWER FLOW: 226.1 KW 74.4 KVAR 238.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .3 KW .1 KVAR .3 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

LOAD TO: 983 9-25 PRI FEEDER AMPS: 10 VOLTAGE DROP: 32. %VD: .2
PROJECTED POWER FLOW: 226.1 KW 74.4 KVAR 238.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .6 KVA

==== BUS: 983 9-25 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13545 %VD: -2.6
===== PU BUS VOLTAGE: 1.026 ANGLE: -.5 DEGREES
 PROJECTED SPECIAL BUS LOAD: 164.8 KW 54.2 KVAR

LOAD FROM: 980 FEEDER AMPS: 10 VOLTAGE DROP: 32. %VD: .2
PROJECTED POWER FLOW: 225.6 KW 74.1 KVAR 237.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .5 KW .2 KVAR .6 KVA

LOAD TO: 984 9-25 SEC TRANSF AMPS: VOLTAGE DROP: 0. %VD: .0
PROJECTED POWER FLOW: .0 KW .0 KVAR .0 KVA PF: .00 LEADING
LOSSES THRU TRANSF: .0 KW .0 KVAR .0 KVA

LOAD TO: 985 9-34 PRI FEEDER AMPS: 3 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 60.8 KW 20.0 KVAR 64.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 984 9-25 SEC DESIGN VOLTAGE: 208 BUS VOLTAGE: 213 %VD: -2.6
===== PU BUS VOLTAGE: 1.026 ANGLE: -.5 DEGREES
**** NO LOAD SPECIFIED ****

==== BUS: 985 9-34 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13542 %VD: -2.6
===== PU BUS VOLTAGE: 1.026 ANGLE: -.5 DEGREES

LOAD FROM: 983 9-25 PRI FEEDER AMPS: 3 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 60.8 KW 20.0 KVAR 64.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 987 FEEDER AMPS: 3 VOLTAGE DROP: 9. %VD: .1
PROJECTED POWER FLOW: 60.8 KW 20.0 KVAR 64.0 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 987 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13533 %VD: -2.5
===== PU BUS VOLTAGE: 1.025 ANGLE: -.5 DEGREES

LOAD FROM: 985 9-34 PRI FEEDER AMPS: 3 VOLTAGE DROP: 9. %VD: .1
PROJECTED POWER FLOW: 60.7 KW 20.0 KVAR 63.9 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 990 9-26 PRI FEEDER AMPS: 2 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 35.5 KW 11.7 KVAR 37.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 992 FEEDER AMPS: 1 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 25.2 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 990 9-26 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13525 %VD: -2.5
===== PU BUS VOLTAGE: 1.025 ANGLE: -.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 35.5 KW 11.7 KVAR

LOAD FROM: 987 FEEDER AMPS: 2 VOLTAGE DROP: 8. %VD: .1
PROJECTED POWER FLOW: 35.5 KW 11.7 KVAR 37.4 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

==== BUS: 992 DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13517 %VD: -2.4
===== PU BUS VOLTAGE: 1.024 ANGLE: -.5 DEGREES

LOAD FROM: 987 FEEDER AMPS: 1 VOLTAGE DROP: 16. %VD: .1
PROJECTED POWER FLOW: 25.1 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

LOAD TO: 997 9-32 PRI FEEDER AMPS: 1 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS

VOLTAGE EFFECT ON LOADS MODELED

VOLTAGE DROP CRITERIA: BRANCH = 4.00 % BUS = 5.00

==== BUS: 997 9-32 PRI DESIGN VOLTAGE: 13200 BUS VOLTAGE: 13514 %VD: -2.4
===== PU BUS VOLTAGE: 1.024 ANGLE: -.5 DEGREES
PROJECTED SPECIAL BUS LOAD: 25.1 KW 8.3 KVAR

LOAD FROM: 992 FEEDER AMPS: 1 VOLTAGE DROP: 3. %VD: .0
PROJECTED POWER FLOW: 25.1 KW 8.3 KVAR 26.5 KVA PF: .95 LAGGING
LOSSES THRU FEEDER: .0 KW .0 KVAR .0 KVA

BALANCED VOLTAGE DROP AND LOAD FLOW BUS DATA SUMMARY

BUS#	NAME	BASE VOLT	PU VOLT	BUS#	NAME	BASE VOLT	PU VOLT
10	GEN G1	2400.00	1.050	15	G1 STEP-UP	2400.00	1.050
20	GEN G2	2400.00	1.045	25	G2 STEP-UP	2400.00	1.045
30	GEN G3	2400.00	1.045	35	G3 STEP-UP	2400.00	1.045
40	GEN G4	4160.00	1.045	50	GEN G5	4160.00	1.045
60	SWGR S	4160.00	1.045	62	SS-1 SEC	480.00	1.045
64	MCC 4&5	480.00	1.045	66	SM1A BLUE	4160.00	1.045
68	BLUE SSS	480.00	1.045	70	SWGR N	4160.00	1.045
80	UTILITY	24900.00	1.000	85	T1 SEC	4160.00	1.045
90	SWGR O	4160.00	1.045	100	FDR 1	4160.00	1.044
105	F1F12 14	4160.00	1.043	110	F1 L14	4160.00	1.042
115	F1 L15	4160.00	1.042	120	F1 L31	4160.00	1.042
121	F1 L63	4160.00	1.041	122	F1 L64	4160.00	1.041
200	FDR 2	4160.00	1.044	205		4160.00	1.043
235	F5 F29	4160.00	1.043	236	F2 F211	4160.00	1.042
240	F1 F213	4160.00	1.042	300	FDR 3	4160.00	1.045
400	FDR 4	4160.00	1.045	500	FDR 5	4160.00	1.045
505	F4 F5 F6UF	4160.00	1.044	512	5-3 PRI	4160.00	1.044
515	F5 L24	4160.00	1.043	525	F5 L31	4160.00	1.043
531	F3 L41	4160.00	1.043	535	F537 L5	4160.00	1.043
555		4160.00	1.043	560	RICH SUB	4160.00	1.042
562	RS SEC	13200.00	1.040	565	5-17 PRI	4160.00	1.042
575	F5 51	4160.00	1.042	580	F5 L85	4160.00	1.042
600	O/H BUS	4160.00	1.045	700	FDR 7	4160.00	1.044
705	WELL9 POL	4160.00	1.044	707	7-1 SEC	480.00	1.044
709	F9 F73	4160.00	1.044	710	F7 L11	4160.00	1.044
715	F7 L13	4160.00	1.043	720	F713	4160.00	1.043
725	7-15 PRI	4160.00	1.043	735	F7 L54	4160.00	1.043
745		4160.00	1.043	750	F7 L72	4160.00	1.043
800	FDR 8	4160.00	1.045	900	FDR 9	4160.00	1.044
905	STEP SEC	13200.00	1.040	910	F 96	13200.00	1.040
915	F910	13200.00	1.040	920	F940	13200.00	1.039
925	()	13200.00	1.040	930	RICH SUB	13200.00	1.040
935	9-8 PRI	13200.00	1.040	940	9-9 PRI	13200.00	1.040
945	F949 L1	13200.00	1.039	960	9-13 PRI	13200.00	1.038
963	9-14 PRI	13200.00	1.034	966	9-15 PRI	13200.00	1.034
969	SW UP	13200.00	1.033	972	SW DOWN	13200.00	1.033
975	9-16 PRI	13200.00	1.030	980		13200.00	1.029
983	9-25 PRI	13200.00	1.026	984	9-25 SEC	208.00	1.026
985	9-34 PRI	13200.00	1.026	987		13200.00	1.025
990	9-26 PRI	13200.00	1.025	992		13200.00	1.024
997	9-32 PRI	13200.00	1.024				

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
10	GEN G1	15	G1 STEP-UP	FDR	.02	229.00	1000.00	49.25
15	G1 STEP-UP	10	GEN G1	FDR	.02	229.00	999.77	49.25
15	G1 STEP-UP	60	SWGR S	TX2	.57	229.00	999.77	UNKNOW
20	GEN G2	25	G2 STEP-UP	FDR	.00	.00	.00	.00
25	G2 STEP-UP	20	GEN G2	FDR	.00	.00	.00	.00
25	G2 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
30	GEN G3	35	G3 STEP-UP	FDR	.00	.00	.00	.00
35	G3 STEP-UP	30	GEN G3	FDR	.00	.00	.00	.00
35	G3 STEP-UP	60	SWGR S	TX2	.00	.00	.00	UNKNOW
40	GEN G4	70	SWGR N	FDR	.00	.00	.00	.00
50	GEN G5	70	SWGR N	FDR	.00	.00	.00	.00
60	SWGR S	15	G1 STEP-UP	TX2	.57	132.12	994.33	UNKNOW
60	SWGR S	25	G2 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	35	G3 STEP-UP	TX2	.00	.00	.00	UNKNOW
60	SWGR S	62	SS-1 SEC	TX2	.00	.01	.07	UNKNOW
60	SWGR S	66	SM1A BLUE	FDR	.00	.01	.10	.00
60	SWGR S	70	SWGR N	FDR	.00	74.85	563.32	16.10
60	SWGR S	100	FDR 1	FDR	.01	24.18	181.96	10.51
60	SWGR S	200	FDR 2	FDR	.01	33.49	252.04	14.56
60	SWGR S	300	FDR 3	FDR	.00	.00	.00	.00
60	SWGR S	400	FDR 4	FDR	.00	.00	.00	.00
60	SWGR S	500	FDR 5	FDR	.00	7.18	54.06	3.12
62	SS-1 SEC	60	SWGR S	TX2	.00	.08	.07	UNKNOW
62	SS-1 SEC	64	MCC 4&5	FDR	.00	.08	.07	.02
64	MCC 4&5	62	SS-1 SEC	FDR	.00	.08	.07	.02
64	MCC 4&5	68	BLUE SSS	FDR	.00	.12	.10	.03
64	MCC 4&5	90	SWGR O	TX2	.00	.20	.17	UNKNOW
66	SM1A BLUE	60	SWGR S	FDR	.00	.01	.10	.00
66	SM1A BLUE	68	BLUE SSS	TX2	.00	.01	.10	UNKNOW
68	BLUE SSS	64	MCC 4&5	FDR	.00	.12	.10	.03
68	BLUE SSS	66	SM1A BLUE	TX2	.00	.12	.10	UNKNOW
70	SWGR N	40	GEN G4	FDR	.00	.00	.00	.00
70	SWGR N	50	GEN G5	FDR	.00	.00	.00	.00
70	SWGR N	60	SWGR S	FDR	.00	74.85	563.32	16.10
70	SWGR N	90	SWGR O	FDR	.00	74.85	563.32	20.23
80	UTILITY	85	T1 SEC	TX2	4.45	8.40	362.22	UNKNOW
85	T1 SEC	80	UTILITY	TX2	4.45	47.76	359.44	UNKNOW
85	T1 SEC	90	SWGR O	FDR	.00	47.76	359.44	12.91
90	SWGR O	64	MCC 4&5	TX2	.00	.02	.17	UNKNOW
90	SWGR O	70	SWGR N	FDR	.00	74.85	563.31	20.23

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
90	SWGR 0	85	T1 SEC	FDR	.00	47.76	359.43	12.91
90	SWGR 0	600	O/H BUS	FDR	.00	.00	.00	.00
90	SWGR 0	700	FDR 7	FDR	.01	29.75	223.88	12.93
90	SWGR 0	800	FDR 8	FDR	.00	.00	.00	.00
90	SWGR 0	900	FDR 9	FDR	.01	40.87	307.61	17.77
100	FDR 1	60	SWGR S	FDR	.01	24.18	181.95	10.51
100	FDR 1	105	F1F12 14	FDR	.19	24.18	181.95	6.77
105	F1F12 14	100	FDR 1	FDR	.19	24.18	181.63	6.77
105	F1F12 14	110	F1 L14	FDR	.02	24.18	181.63	6.77
110	F1 L14	105	F1F12 14	FDR	.02	24.18	181.59	6.77
110	F1 L14	115	F1 L15	FDR	.00	.00	.00	.00
110	F1 L14	120	F1 L31	FDR	.05	24.18	181.59	6.77
115	F1 L15	110	F1 L14	FDR	.00	.00	.00	.00
120	F1 L31	110	F1 L14	FDR	.05	24.18	181.50	6.77
120	F1 L31	121	F1 L63	FDR	.04	17.70	132.85	4.96
121	F1 L63	120	F1 L31	FDR	.04	17.70	132.80	4.96
121	F1 L63	122	F1 L64	FDR	.01	11.22	84.18	3.14
122	F1 L64	121	F1 L63	FDR	.01	11.22	84.17	3.14
200	FDR 2	60	SWGR S	FDR	.01	33.49	252.02	14.56
200	FDR 2	205	FDR 2	FDR	.10	33.49	252.02	9.38
205	FDR 2	200	FDR 2	FDR	.10	33.49	251.77	9.38
205	F5 F29	235	F5 F29	FDR	.07	33.49	251.77	9.38
235	F5 F29	205	FDR 2	FDR	.07	33.49	251.60	9.38
235	F5 F29	236	F2 F211	FDR	.03	26.81	201.40	7.51
236	F2 F211	235	F5 F29	FDR	.03	26.81	201.34	7.51
236	F2 F211	240	F1 F213	FDR	.02	13.40	100.66	3.75
240	F1 F213	236	F2 F211	FDR	.02	13.40	100.64	3.75
300	FDR 3	60	SWGR S	FDR	.00	.00	.00	.00
400	FDR 4	60	SWGR S	FDR	.00	.00	.00	.00
500	FDR 5	60	SWGR S	FDR	.00	7.18	54.06	3.12
500	FDR 5	505	F4 F5 F6UF	FDR	.02	7.18	54.06	2.01
505	F4 F5 F6UF	500	FDR 5	FDR	.02	7.18	54.04	2.01
505	F4 F5 F6UF	512	5-3 PRI	FDR	.06	7.18	54.04	2.01
512	5-3 PRI	505	F4 F5 F6UF	FDR	.06	7.18	54.01	2.01
512	5-3 PRI	515	F5 L24	FDR	.05	7.18	54.01	2.01
515	F5 L24	512	5-3 PRI	FDR	.05	7.18	53.99	2.01
515	F5 L24	525	F5 L31	FDR	.01	7.18	53.99	2.01
525	F5 L31	515	F5 L24	FDR	.01	7.18	53.99	2.01
525	F5 L31	531	F3 L41	FDR	.01	2.97	22.29	.83
525	F5 L31	535	F537 L5	FDR	.02	2.97	22.29	.83

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
531	F3 L41	525	F5 L31	FDR	.01	2.97	22.29	.83
531	F3 L41	535	F537 L5	FDR	.01	2.97	22.29	.83
535	F537 L5	525	F5 L31	FDR	.02	2.97	22.29	.83
535	F537 L5	531	F3 L41	FDR	.01	2.97	22.29	.83
535	F537 L5	555		FDR	.03	5.93	44.58	2.15
555		555	F537 L5	FDR	.03	5.93	44.56	2.15
555		560	RICH SUB	FDR	.09	3.91	29.35	1.42
555		565	5-17 PRI	FDR	.01	2.03	15.24	.73
560	RICH SUB	555		FDR	.09	3.91	29.32	1.42
560	RICH SUB	565	RS SEC	TX2	.12	3.91	29.32	UNKNOW
562	RS SEC	560	RICH SUB	TX2	.12	1.23	29.29	UNKNOW
562	RS SEC	930	RICH SUB	FDR	.00	1.23	29.29	.88
565	5-17 PRI	555		FDR	.01	2.03	15.24	.73
565	5-17 PRI	575	F5 51	FDR	.00	1.25	9.40	.45
575	F5 51	565	5-17 PRI	FDR	.00	1.25	9.40	.45
575	F5 51	580	F5 L85	FDR	.01	1.25	9.40	.45
580	F5 L85	575	F5 51	FDR	.01	1.25	9.39	.45
600	O/H BUS	90	SWGR 0	FDR	.00	.00	.00	.00
700	FDR 7	90	SWGR 0	FDR	.01	29.75	223.86	12.93
700	FDR 7	705	WELL9 POL	FDR	.01	29.75	223.86	8.33
705	WELL9 POL	700	FDR 7	FDR	.01	29.75	223.85	8.33
705	WELL9 POL	707	7-1 SEC	TX2	.00	.00	.00	UNKNOW
705	WELL9 POL	709	F9 F73	FDR	.02	23.47	176.59	6.57
707	7-1 SEC	705	WELL9 POL	TX2	.00	.00	.00	UNKNOW
709	F9 F73	705	WELL9 POL	FDR	.02	23.47	176.55	6.57
709	F9 F73	710	F7 L11	FDR	.06	10.82	81.40	3.03
710	F7 L11	709	F9 F73	FDR	.06	10.82	81.36	3.03
710	F7 L11	715	F7 L13	FDR	.01	3.21	24.11	.90
710	F7 L11	720	F713	FDR	.01	4.46	33.57	1.25
715	F7 L13	710	F7 L11	FDR	.01	3.21	24.10	.90
720	F713	710	F7 L11	FDR	.01	4.46	33.56	1.25
720	F713	725	7-15 PRI	FDR	.03	4.46	33.56	1.25
725	7-15 PRI	720	F713	FDR	.03	4.46	33.56	1.25
725	7-15 PRI	735	F7 L54	FDR	.01	4.46	33.56	1.25
735	F7 L54	725	7-15 PRI	FDR	.01	4.46	33.55	1.25
735	F7 L54	745		FDR	.01	3.20	24.08	.90
745		735	F7 L54	FDR	.01	3.20	24.08	.90
745		750	F7 L72	FDR	.01	3.20	24.08	.90
750	F7 L72	745		FDR	.01	3.20	24.08	.90
800	FDR 8	90	SWGR 0	FDR	.00	.00	.00	.00

DATE:27 NOV 95 TIME: 9 12 AM PAGE 42
CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
900	FDR 9	90	SWGR 0	FDR	.01	40.87	307.58	17.77
900	FDR 9	905	STEP SEC	TX2	.43	40.87	307.58	UNKNOW
905	STEP SEC	900	FDR 9	TX2	.43	12.88	306.32	UNKNOW
905	STEP SEC	910	F 96	FDR	.01	12.88	306.32	3.61
910	F 96	905	STEP SEC	FDR	.01	12.88	306.28	3.61
910	F 96	915	F910	FDR	.02	12.03	286.00	3.37
915	F910	910	F 96	FDR	.02	12.03	285.96	3.37
915	F910	920	F940	FDR	.09	12.03	285.96	3.37
920	F940	915	F910	FDR	.09	12.03	285.72	3.37
920	F940	945	F949 L1	FDR	.02	12.03	285.72	3.37
925	()	930	RICH SUB	FDR	.01	1.23	29.28	.88
925	()	935	9-8 PRI	FDR	.01	1.23	29.28	1.17
930	RICH SUB	562	RS SEC	FDR	.00	1.23	29.29	.88
930	RICH SUB	925	()	FDR	.01	1.23	29.29	.88
935	9-8 PRI	925	()	FDR	.01	1.23	29.28	1.17
935	9-8 PRI	940	9-9 PRI	FDR	.03	.74	17.57	.70
940	9-9 PRI	935	9-8 PRI	FDR	.03	.74	17.56	.70
945	F949 L1	920	F940	FDR	.02	12.03	285.68	3.37
945	F949 L1	960	9-13 PRI	FDR	.10	11.82	280.73	6.42
960	9-13 PRI	945	F949 L1	FDR	.10	11.82	280.45	6.42
960	9-13 PRI	963	9-14 PRI	FDR	.33	10.97	260.26	5.96
963	9-14 PRI	960	9-13 PRI	FDR	.33	10.97	259.42	5.96
963	9-14 PRI	966	9-15 PRI	FDR	.09	10.12	239.36	5.50
966	9-15 PRI	963	9-14 PRI	FDR	.09	10.12	239.16	5.50
966	9-15 PRI	969	SW UP	FDR	.02	10.12	239.16	5.50
969	SW UP	966	9-15 PRI	FDR	.02	10.12	239.10	5.50
969	SW UP	972	SW DOWN	FDR	.00	10.12	239.10	2.18
972	SW DOWN	969	SW UP	FDR	.00	10.12	239.10	2.18
972	SW DOWN	975	9-16 PRI	FDR	.34	10.12	239.10	5.50
975	9-16 PRI	972	SW DOWN	FDR	.34	10.12	238.32	5.50
975	9-16 PRI	980		FDR	.14	10.12	238.32	5.50
980		975	9-16 PRI	FDR	.14	10.12	237.99	5.50
980		983	9-25 PRI	FDR	.24	10.12	237.99	5.50
983	9-25 PRI	980		FDR	.24	10.12	237.43	5.50
983	9-25 PRI	984	9-25 SEC	TX2	.00	.00	.00	UNKNOW
983	9-25 PRI	985	9-34 PRI	FDR	.02	2.73	63.97	1.48
984	9-25 SEC	983	9-25 PRI	TX2	.00	.00	.00	UNKNOW
985	9-34 PRI	983	9-25 PRI	FDR	.02	2.73	63.95	1.48
985	9-34 PRI	987		FDR	.07	2.73	63.95	1.48
987		985	9-34 PRI	FDR	.07	2.73	63.91	1.48

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CASE 4 LOAD FLOW STUDY - UTILITY AND ONE GENERATOR RUNNING 4160V SYSTEM
FORT GREELY, ALASKA - POST 2001 CASE
E M C ENGINEERS, INC. - DENVER, COLORADO

BALANCED VOLTAGE DROP AND LOAD FLOW BRANCH DATA SUMMARY

FROM	NAME	TO	NAME	TYPE	VD%	AMPS	KVA	RATING%
987		990	9-26 PRI	FDR	.06	1.60	37.42	.87
987		992		FDR	.12	1.13	26.49	.61
990	9-26 PRI	987		FDR	.06	1.60	37.39	.87
992		987		FDR	.12	1.13	26.46	.61
992		997	9-32 PRI	FDR	.02	1.13	26.46	.61
997	9-32 PRI	992		FDR	.02	1.13	26.46	.61

NOTE: FOR FEEDERS, RATING% = LOAD FLOW AMPS / FLA.
FLA = LIBRARY FLA EXCLUDING DUCT BANK AND TEMP. DERATING FOR CABLES.
FLA = BRANCH RECORD INPUT FLA FOR IMPEDANCE DATA.

NOTE: FOR TRANSFORMERS, RATING% = LOAD FLOW KVA / TRANSFORMER FULL LOAD KVA.

81 BUSES

*** TOTAL SYSTEM LOSSES ***
11.2 KW 43.1 KVAR

WARNING STUDY CONTAINS 2 VOLTAGE CRITERIA VIOLATIONS
VIOLATIONS DENOTED BY (\$) AT BUS AND BRANCH %VD LOCATIONS

APPENDIX J

Construction Cost Estimates

Mon 08 Jan 1996
Eff. Date 01/08/96

PROJECT GRXY-1: U.S. Army Corps of Engineers
Fort Greely, AK(1995-1997 Study) - Energy Efficiency Study
Pt. Greely Electrical Study (1995-1997)

TIME 15:01:32
TITLE PAGE 1

Fort Greely, AK(1995-1997 Study)
Energy Efficiency Study
Power Distribution
1995-1997 Study

Designed By: DM
Estimated By:

Prepared By: TCP

Preparation Date: 01/08/96
Effective Date of Pricing: 01/08/96

Sales Tax: 0.00%

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Currency in DOLLARS

CREW ID: FRBK94 UPB ID: ANCH94

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02. Exterior Electrical Distribution.....1

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Mon 08 Jan 1996
Eff. Date 01/08/96

U.S. Army Corps of Engineers
PROJECT GRLY-1: Fort Greely, AK(1995-1997 Study) - Energy Efficiency Study
Ft. Greely Electrical Study (1995-1997)
** PROJECT DIRECT SUMMARY - Scope **

TIME 15:01:32
SUMMARY PAGE 1

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR EQUIPMENT	TOTAL COST	UNIT COST
20 Site Electrical Utilities	1.00	EA	280,796	7,038	293,802	36,975	611,573 611573.10
TOTAL Fort Greely, AK(1995-1997 Study)	1.00	EA	280,796	7,038	293,802	36,975	611,573 611573.10
Contractor's Overhead							91,736
SUBTOTAL							703,309
Contractor's Profit							70,331
SUBTOTAL							773,640
Contractor's Bond							23,209
TOTAL INCL INDIRECTS							796,849
Escalation							31,874
SUBTOTAL							828,723
Contingency							165,745
TOTAL INCL OWNER COSTS							994,468

20.02. Exterior Electrical Distribution					QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMT	TOTAL COST

20. Site Electrical Utilities											
20.02. Exterior Electrical Distribution											
20.02.01. Transformers											
M MIL AA	<16121	1207	> #4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Reconnect 1 single phase transformer.		76.00	EA	311	67	2,923	9	3,243
M MIL AA	<16121	1207	> #4/0AWG Compr Lugs,1Hole,Wrapped Low Voltage - To 600 Volts Represents (69) 3-phase transformers made up of 3 single phase transformers.		207.00	EA	847	182	7,962	24	8,833
M MIL AA	<16330	4122	> 112.5KVA,Pr14160Grdy/-13800V,Sec 208Y/120,3 Ph,Oil Xfmr,Pad Mtd		1.00	EA	7,837	27	1,197	29	9,063
M MIL AA	<16330	4124	> 225 KVA,Pr14160Grdy/-13800V,Sec 208Y/120,3 Ph,Oil Xfmr,Pad Mtd		1.00	EA	10,519	46	1,996	48	12,563
M MIL AA	<16330	4126	> 500 KVA,Pr14160Grdy/-13800V,Sec 208Y/120,3 Ph,Oil Xfmr,Pad Mtd		3.00	EA	47,521	246	10,777	261	58,559
TOTAL Transformers							67,034	567	24,856	372	92,261

20.02.04. Towers, Poles, Crossarms & Insulators											
M MIL AA	<16413	2102	> 3-1/2"x 4-1/2"x 8'0",Single Arm Wood Crossarm,w/Hardware &Braces		66.00	EA	1,356	113	4,673	831	6,859
M MIL AA	<16413	4101	> 5KV Class 55-3,Pin Insul w/Pin		594.00	EA	3,962	759	31,258	5,559	40,779
M MIL AA	<16413	4101	> 5KV Class 55-3,Pin Insul w/Pin		1318.00	EA	8,791	1,683	69,357	12,336	90,483
M MIL AA	<16120	6008	> #4/0 AWG ACRS Cable Penguin 6/1 Installed on Poles,Aluminum Cabl		163.70	MLF	85,525	2,858	117,122	15,071	217,718
USR AA	<		> Step-up Transformer for Gen #1 Material price taken from Means Electrical Cost Data 1995, labor price taken from Richardson Cost Guide for Fairbanks.		1.00	EA	23,300	87	3,168	465	26,933
USR AA	<		> Step-up Transformer for Gen #2 Material price taken from Means Electrical Cost Data 1995, labor rate taken from Richardson Cost Guide for Fairbanks.		1.00	EA	23,300	87	3,168	465	26,933
USR AA	<		> Step-up Transformer for Gen #3 Material cost taken from Means Electrical Cost Data 1995, labor rates taken from Richardson Cost Guide for Fairbanks, AK.		1.00	EA	23,300	87	3,168	465	26,933
USR AA	<		> Convert G4 to Wye		1.00	EA	100	16	583	0	683

Mon 08 Jan 1996
Eff. Date 01/08/96
DETAILED ESTIMATE

U.S. Army Corps of Engineers
Fort Greely, AK(1995-1997 Study) - Energy Efficiency Study
PROJECT GRLY-1: Ft. Greely Electrical Study (1995-1997)
20. Site Electrical Utilities

TIME 15:01:32
DETAIL PAGE 2

20.02. Exterior Electrical Distribution

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMT	TOTAL COST
USR AA <	1.00	EA	100	16	583	0	683
M MIL AA <16452 1001 >	1/2"	Diag10'L Ground Rods,Cu-Clad	329.00	422	18,496	56	22,221
M MIL AA <16453 1001 >	1/2"	Ground Rod Clamp	329.00	137	6,011	18	6,786
M MIL AA <16120 7105 >	#4 AWG 1/c Bare Strd Cu Cable	16.47	MLF	206	8,446	1,087	14,136
		Installed on Poles					
USR AA <	1.00	EA	35,000	0	2,915	250	38,165
		> Vacuum Circuit Breaker					
		TOTAL Towers, Poles, Crossarms &	213,762	6,471	268,947	36,603	519,312
		TOTAL Exterior Electrical Distribution	280,796	7,038	293,802	36,975	611,573
		TOTAL Site Electrical Utilities	280,796	7,038	293,802	36,975	611,573
		TOTAL Fort Greely, AK(1995-1997 Study)	280,796	7,038	293,802	36,975	611,573

Mon 08 Jan 1996
Eff. Date 01/08/96

PROJECT GRLY-2: U.S. Army Corps of Engineers
Fort Greely, AK(Post 2001 Study) - Energy Efficiency Study
Ft. Greely Electrical Study (Post 2001)

TIME 15:04:14

TITLE PAGE 1

Fort Greely, AK(Post 2001 Study)
Energy Efficiency Study
Power Distribution
Post 2001 Study

Designed By: DM
Estimated By:

Prepared By: TCP

Preparation Date: 01/08/96
Effective Date of Pricing: 01/08/96

Sales Tax: 0.00%

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02. Exterior Electrical Distribution.....1

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PROJECT GRLY-2: U.S. Army Corps of Engineers
Fort Greely, AK(Post 2001 Study) - Energy Efficiency Study
Ft. Greely Electrical Study (Post 2001)
** PROJECT DIRECT SUMMARY - Scope **

TIME 15:04:14
SUMMARY PAGE 1

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR EQUIPMNT	TOTAL COST	UNIT COST
20 Site Electrical Utilities	1.00	EA	201,734	5,035	209,758	27,646	439,137 439137.36
TOTAL Fort Greely, AK(Post 2001 Study)	1.00	EA	201,734	5,035	209,758	27,646	439,137 439137.36
Contractor's Overhead							65,871
SUBTOTAL							505,008
Contractor's Profit							50,501
SUBTOTAL							555,509
Contractor's Bond							16,665
TOTAL INCL INDIRECTS							572,174
Escalation							22,887
SUBTOTAL							595,061
Contingency							119,012
TOTAL INCL OWNER COSTS							714,073

Mon 08 Jan 1996
Eff. Date 01/08/96
DETAILED ESTIMATE

U.S. Army Corps of Engineers
Fort Greely, AK(Post 2001 Study) - Energy Efficiency Study
PROJECT GRLY-2: Ft. Greely Electrical Study (Post 2001)
20. Site Electrical Utilities

TIME 15:04:14
DETAIL PAGE 2

20.02. Exterior Electrical Distribution

QUANTITY UOM MATERIAL						MANHRS	LABOR EQUIPMT	TOTAL COST
USR AA <	> Convert G4 to Wye	1.00 EA	100	16	583	0	683	
USR AA <	> Convert G5 to Wye	1.00 EA	100	16	583	0	683	
M MIL AA <	16452 1001 > 1/2" Dia x 10' L Ground Rods, Cu-Clad	244.00 EA	2,721	313	13,717	42	16,480	
M MIL AA <	16453 1001 > 1/2", Ground Rod Clamp	244.00 EA	561	102	4,458	14	5,033	
M MIL AA <	16120 7105 > #4 AWG 1/c Bare Strd Cu Cable	12.20 MLF	3,410	153	6,256	805	10,471	
USR AA <	Installed on Poles							
USR AA <	> Vacuum Circuit Breaker	1.00 EA	35,000	0	2,915	250	38,165	
TOTAL Towers, Poles, Crossarms &						4,872	202,857	27,552
TOTAL Exterior Electrical Distribution						5,035	209,758	27,646
TOTAL Site Electrical Utilities						5,035	209,758	27,646
TOTAL Fort Greely, AK(Post 2001 Study)						5,035	209,758	27,646

20.02. Exterior Electrical Distribution		QUANTITY	UOM	MATERIAL	MANHRS	LABOR EQUIPMENT	TOTAL COST
20. Site Electrical Utilities							
20.02. Exterior Electrical Distribution							
20.02.01. Transformers							
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs, 1Hole, Wrapped Low Voltage - To 600 Volts Reconnect 1 single phase transformer.	4.00	EA	16	4	154	171
M MIL AA <16121 1207 >	#4/0AWG Compr Lugs, 1Hole, Wrapped Low Voltage - To 600 Volts Represents (17) 3-phase single phase transformers made up of 3 transformers	51.00	EA	209	45	1,962	2,176
M MIL AA <16330 4126 >	500 KVA, Pri4160Grdy/-13800V, Sec 208Y/120, 3 Ph, Oil Xfmr, Pad Mtd	1.00	EA	15,840	83	3,629	19,557
USR AA <	> Disconnect Existing Transformer Assume 15 min/transformer at labor rate taken from Richardson Cost Estimating Guide for Fairbanks.	127.00	EA	0	32	1,157	1,157
TOTAL Transformers				16,065	163	6,901	23,061
20.02.04. Towers, Poles, Crossarms & Insulators							
M MIL AA <16413 2102 >	3-1/2"x 4-1/2"x 8'0", Single Arm Wood Crossarm, w/Hardware & Braces	49.00	EA	1,006	84	3,469	5,092
M MIL AA <16413 4101 >	5KV Class 55-3, Pin Insul w/Pin	440.00	EA	2,935	562	23,154	4,118
M MIL AA <16413 4101 >	5KV Class 55-3, Pin Insul w/Pin	976.00	EA	6,510	1,246	51,360	9,135
M MIL AA <16120 6008 >	#4/0 AWG ACRS Cable Penguin 6/1 Installed on Poles, Aluminum Cabl	121.40	MLF	63,425	2,119	86,858	11,176
USR AA <	> Step-up Transformer for Gen #1 Material price taken from Means Electrical Cost Data 1995, labor price taken from Richardson Cost Guide for Fairbanks.	1.00	EA	23,300	87	3,168	465
USR AA <	> Step-up Transformer for Gen #2 Material price taken from Means Electrical Cost Data 1995, labor rate taken from Richardson Cost Guide for Fairbanks.	1.00	EA	23,300	87	3,168	465
USR AA <	> Step-up Transformer for Gen #3 Material cost taken from Means Electrical Cost Data 1995, labor rates taken from Richardson Cost Guide for Fairbanks, AK.	1.00	EA	23,300	87	3,168	465

APPENDIX K

LCCA and Economic Analysis

ENERGY USAGE AND COST PROVIDED TO FT. GREELY BY GVEA

Month	1 (FGR) TOTAL kWh Received @ Ft. Greely	2 (FWO) Ft. Wain. Output to GVEA	3 (WE) Ft. Wain. Wheeled to Ft. Greely	4 (PE) Ft. Greely kWh Rec'd. from GVEA	5 (EC) Cost of Electricity from GVEA	6 (WC) Cost of Wheeling to Ft. Greely	7 (D) Demand kW	8 (DC) Demand Charge	9 (MC) Misc.	10 (TC) Resulting Billing
Sep-93	1,249,440	1,411,310	1,254,655	(5,215)	\$0	\$16,829	2,424	\$15,150	\$55	\$32,034
Oct-93	1,396,800	1,493,260	1,327,508	69,292	\$5,552	\$17,803	2,736	\$17,100	(\$1,323)	\$39,132
Nov-93	1,531,680	1,168,380	1,038,690	492,990	\$37,668	\$13,941	2,904	\$18,150	(\$9,748)	\$60,011
Dec-93	1,591,680	1,145,270	1,018,145	573,535	\$43,773	\$13,667	2,904	\$18,150	(\$10,825)	\$64,765
Jan-94	1,563,840	1,843,700	1,639,049	(75,209)	\$0	\$21,969	2,976	\$18,600	\$55	\$40,624
Feb-94	1,483,920	1,423,250	1,265,269	218,651	\$16,873	\$16,971	2,904	\$18,150	(\$4,103)	\$47,891
Mar-94	1,572,000	1,322,760	1,175,934	396,066	\$30,321	\$15,776	2,784	\$17,400	(\$7,134)	\$56,363
Apr-94	1,365,600	1,201,590	1,068,214	297,386	\$22,841	\$14,336	2,688	\$16,800	(\$6,317)	\$47,660
May-94	1,214,400	1,326,000	1,178,814	35,586	\$2,997	\$15,815	2,544	\$15,900	(\$1,514)	\$33,198
Jun-94	1,116,000	984,850	875,532	240,468	\$18,527	\$11,760	2,256	\$14,100	(\$5,279)	\$39,107
Jul-94	1,092,000	967,630	860,223	231,777	\$17,868	\$11,555	2,184	\$13,650	(\$4,963)	\$38,110
Aug-94	1,140,000	1,251,190	1,112,308	27,692	\$2,398	\$14,926	2,280	\$14,250	(\$1,663)	\$29,911
TOTAL	16,317,360	15,539,190	13,814,340	2,503,020	\$198,818	\$185,347	31,584	\$197,400	(\$52,759)	\$528,806

1. Total kWhs into Ft. Greely read at the Ft. Greely meter = FGR
2. kWh output from Ft. Wainwright Power Plant to GVEA measured at the Ft. Wainwright meter = FWO
3. Amount of electricity wheeled to Ft. Greely from Ft. Wainwright less 11.1% line losses = WE = FWO X 0.889
4. Ft. Greely purchased electricity from GVEA = PE = FGR - WE
5. Cost of electricity purchased from GVEA based on the GVEA GS-2 rate schedule = EC = 500 X .1136 + 4500 X .099 + 10000 X .0934 + (PE - 15000) X .0758. If PE < 0, then EC = 0.
6. Cost of wheeling electricity from Ft. Wainwright to Ft. Greely at 17.64% of the GVEA GS-2 rate schedule = WC = (500 X .1136 + 4500 X .099 + 10000 X .0934 + (WE - 15000) X .0758) X .1764
7. Peak monthly demand recorded at Ft. Greely meter.
8. Demand charge = DC = D X 6.25
9. Miscellaneous adjustments account for customer charge, power adjustment, late charges, & regulatory charges.
10. Total billing is the sum of all charges = TC = EC + WC + DC + MC

11. Cost electric of power from GVEA:
 $= (EC + MC) / PE$

12. Cost of electric power from GVEA:
 (with demand charge incorporated into the energy rate)
 $= (TC - WC) / PE$

13. Cost of electric power wheeled
 from Fort Wainwright:
 $= WC / WE + 0.06$

14. Weighted cost of electric power:
 (considering both sources)
 $= (PE / FGR) \times (\#11 \text{ or } \#12) + (WE / FGR) \times (\#13)$

Energy Only =	\$0.0584	per kWh
Demand Only =	\$ 6.25	per kW-month
Demand & Energy =	\$0.1372	per kWh
Wheeling Cost =	\$0.0134	per kWh
Generation Cost =	\$0.0600	per kWh
Total Cost =	\$0.0734	per kWh
Energy Only =	\$0.0711	per kWh
Demand Only =	\$ 6.25	per kW-month
Demand & Energy =	\$0.0832	per kWh

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Fl Greely AK 99703

DATE OCTOBER 7, 1993

ACCOUNT NO: 010-4410-00

REGARDING Fl Greely in from GVEA

BILLING PERIOD SEPTEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	7909.7	7899.1		820.6			1,249,440			
	DEMAND				1.01			2,424			
70197	10	871,963	790,832		141,131			1,411,310			
FWO - 11.1% = WE		156,655						1,254,655			
FORT GREELY KWH RECEIVED								1,249,440			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,254,655			
PURCHASED ELECTRICITY								(5,215)			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
0 KWH @			0.1136					0.00			
0 KWH @			0.0990					0.00			
0 KWH @			0.0634					0.00			
0 KWH @			0.0758					0.00			
COST OF POWER ADJUSTMENT			0.02027 PER/KWH					0.00			
POWER WHEELED								16,828.93			
DEMAND		2424 KW @ \$6.25						15,150.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000626 CENTS/KWH						0.00			
TOTAL BILL								\$2,033.93			
THIS INVOICE DUE AND PAYABLE 28 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$32,033.93

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$66,872.94

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$98,906.87

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
FL Greely AK 99703

DATE OCTOBER 7, 1993

ACCOUNT NO: 010-4410-00

REGARDING FL Greely in from GVEA

BILLING PERIOD OCTOBERS 1993

METER NO.	MULT.	PREL. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	8491.7	7906.7		582			1,396,800			
DEMAND								1.14	2,736		
70197	10	1,021,289	871,963		140,326			1,493,260			
FWO - 11.1% = WE								165,752	1,327,508		
FORT GREELY KWH RECEIVED									1,396,800		
FORT WAINWRIGHT ADJUSTED OUTPUT									1,327,508		
PURCHASED ELECTRICITY								66,292			
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00		
500 KWH @								0.1136	56.80		
4500 KWH @								0.0990	445.50		
10,000 KWH @								0.0934	934.00		
64,292 KWH @								0.0758	4,115.32		
COST OF POWER ADJUSTMENT								0.02027 PER/KWH	(1,404.55)		
POWER WHEELED									17,803.07		
DEMAND 2736 KW @ \$6.25									17,100.00		
LATE CHARGE									15.00		
REGULATORY CHARGES @ 0.000386 CENTS/KWH									26.75		
TOTAL BILL									89,131.89		
THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$89,131.89

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$88,906.87

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$138,036.76

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

760 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE DECEMBER 7, 1993

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD NOVEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	9129.9	8491.7		636.2			1,531.680			
	DEMAND				1.21			2.604			
70197	10	136,127	21,269		116,858			1,168,960			
FWO - 11.1% = WE		129,600						1,036,600			
FORT GREELY KWH RECEIVED								1,531,680			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,036,600			
PURCHASED ELECTRICITY								492,990			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
	500 KWH @		0.1136					56.80			
	4500 KWH @		0.0090					445.50			
	10,000 KWH @		0.0034					34.00			
	477,990 KWH @		0.0758					36,231.66			
COST OF POWER ADJUSTMENT			0.02027 PER/KWH					(9,982.91)			
POWER WHEELED								13,941.24			
DEMAND 2904 KW @ \$6.25								18,150.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @ 0.000386 CENTS/KWH								190.29			
TOTAL BILL								90,011.58			
THIS INVOICE DUE AND PAYABLE 30 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$90,011.58

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$39,131.89

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$90,143.47

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft Greely AK 99703

DATE JANUARY 7, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft Greely In from GVEA

BILLING PERIOD DECEMBER 1993

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	9793.1	9129.9		863.2			1,591,680			
DEMAND								1.21	2,904		
70167	10	252,654	138,127		114,527			1,145,270			
FWO - 11.1% = WE								127,125	1,018,145		
FORT GREELY KWH RECEIVED									1,591,680		
FORT WAINWRIGHT ADJUSTED OUTPUT									1,018,145		
PURCHASED ELECTRICITY									573,535		
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00		
500 KWH @								0.1136	56.80		
4500 KWH @								0.0990	445.50		
10,000 KWH @								0.0934	934.00		
558,535 KWH @								0.0758	42,336.95		
COST OF POWER ADJUSTMENT								0.01933 PER/KWH	(11,086.43)		
POWER WHEELED									13,666.54		
DEMAND								2904 KW @ \$6.25	18,150.00		
LATE CHARGE									0.00		
REGULATORY CHARGES @								0.000386 CENTS/KWH	221.36		
TOTAL BILL									64,764.74		
THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$64,764.74

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$0.00

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$64,764.74

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

766 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

TICN

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Pt. Greely AK 99703

DATE FEBRUARY 2, 1994

ACCOUNT NO: 010-4410-00

REGARDING Pt. Greely In from GVEA

BILLING PERIOD JANUARY 1994

METER NO.	MULT.	PREL. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRUE CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
7175	2400	10444.7	8793.1		851.8			1,583,840			
	DEMAND				1.24			2,976			
70197	10	437,024	252,854		184,370			1,843,700			
FWO - 11.1% = WE		204,851						1,639,049			
FORT GREELY KWH RECEIVED								1,583,840			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,639,049			
PURCHASED ELECTRICITY								(75,200)			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
	0 KWH @		0.1136					0.00			
	0 KWH @		0.0090					0.00			
	0 KWH @		0.0034					0.00			
	0 KWH @		0.0758					0.00			
COST OF POWER ADJUSTMENT			0.01833 PER/KWH					0.00			
POWER WHEELED								21,968.72			
DEMAND		2976 KW @ \$6.25						18,600.00			
LATE CHARGE								15.00			
REGULATORY CHARGES @		0.000386 CENTS/KWH						0.00			
TOTAL BILL								40,623.72			
THIS INVOICE DUE AND PAYABLE 28 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$40,623.72

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$84,764.74

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$105,388.46

(See statement for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Fl Greely AK 99703

DATE MARCH 8, 1994

ACCOUNT NO: 010-4410-00

REGARDING Fl Greely in from GVEA

BILLING PERIOD FEBRUARY 1994

METER NO.	MULT.	PREL READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	MTS TOTAL	TAX TOTAL
7175	2400	1063	444.7		618.8			1,483.920			
DEMAND								1.21	2.904		
70197	10	579,940	437,024		142,925			1,423,250			
FWO - 11.1% = WE								157,981	1,265,269		
FORT GREELY KWH RECEIVED									1,483,920		
FORT WANWRIGHT ADJUSTED OUTPUT									1,265,269		
PURCHASED ELECTRICITY									218,651		
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00		
500 KWH @								0.1136	56.80		
4500 KWH @								0.0090	445.50		
10,000 KWH @								0.0034	934.00		
203,651 KWH @								0.0758	15,436.73		
COST OF POWER ADJUSTMENT								0.01933 PER/KWH	(4,226.52)		
POWER WHEELED									16,970.86		
DEMAND								2904 KW @ \$6.25	18,150.00		
LATE CHARGE									0.00		
REGULATORY CHARGES @								0.000386 CENTS/KWH	84.40		
TOTAL BILL									47,691.77		
THIS INVOICE DUE AND PAYABLE 28 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$47,691.77

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$0.00

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$47,691.77

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

755 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE APRIL 6, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD MARCH 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	NET TOTAL	TAX TOTAL
7175	2400	1522	1063		459			1,101,800			
70076	2400	196	0 meter change		106			470,400			
							1.16	2,784			
70197	10	711,825	579,349		132,276			1,822,760			
FWO - 11.1% = WE		146,826						1,175,934			
FORT GREELY KWH RECEIVED								1,572,000			
FORT WAINWRIGHT ADJUSTED OUTPUT								1,175,934			
PURCHASED ELECTRICITY								366,066			
POWER PURCHASE COSTS											
CUSTOMER CHARGE								40.00			
500 KWH @			0.1136					56.80			
4500 KWH @			0.0600					445.50			
10,000 KWH @			0.0634					634.00			
361,066 KWH @			0.0756					27,284.63			
COST OF POWER ADJUSTMENT			0.0185 PER/KWH					(7,327.23)			
POWER WHEELED								15,776.35			
DEMAND 2784 KW @ \$6.25								17,400.00			
LATE CHARGE								0.00			
REGULATORY CHARGES @ 0.000386 CENTS/KWH								152.86			
TOTAL BILL								64,363.13			
THIS INVOICE DUE AND PAYABLE 25 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$56,363.13

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$0.00

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$56,363.13

(See contract for penalty information)

CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft Greely AK 99703

DATE MAY 4, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft Greely in from GVEA

BILLING PERIOD APRIL 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70976	2400	765	186		800			1,365,600			
	DEMAND				1.12			2,688			
70187	10	831,764	711,825		120,150		1,201,500				
FWO > 120% OF FT. GREELY DEMAND								43,855	1,157,735		
FWO - 11.1% = WE								128,500	1,029,226		
FORT GREELY KWH RECEIVED									1,365,600		
FORT WAINWRIGHT ADJUSTED OUTPUT									1,029,226		
PURCHASED ELECTRICITY									336,374		
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00		
500 KWH @								0.1136	56.80		
4500 KWH @								0.0090	445.50		
10,000 KWH @								0.0034	634.00		
321,374 KWH @								0.0758	24,360.12		
COST OF POWER ADJUSTMENT								0.01833 PER/KWH	(6,502.10)		
POWER WHEELED									13,814.71		
DEMAND								2688 KW @ \$8.25	16,800.00		
LATE CHARGE									15.00		
REGULATORY CHARGES @								0.000386 CENTS/KWH	129.84		
TOTAL BILL									50,063.66		
THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$50,063.66

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$56,362.83

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$106,456.60

(See contract for penalty information)

CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

756 ILLINOIS STREET - BOX 71249
FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft. Greely AK 99703

DATE JUNE 6, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely in from GVEA

BILLING PERIOD MAY 1994

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRUE CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	NET TOTAL	TAX TOTAL
70076	2400	1271 ✓	785 ✓		806 ✓			1,214,400 ✓			
	DEMAND				1.06			2,544 ✓			
70187	10	964,364 ✓	831,784 ✓		132,600 ✓		1,326,000 ✓				
FWO > 120% OF FT. GREELY DEMAND								\$3,163	1,272,647 ✓		
FWO - 11.1% = WE								141,266 ✓	1,131,561 ✓		
FORT GREELY KWH RECEIVED									1,214,400 ✓		
FORT WAINWRIGHT ADJUSTED OUTPUT									1,131,561 ✓		
PURCHASED ELECTRICITY									82,839 ✓		
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00 ✓		
500 KWH @ 0.1136									\$6.80 ✓		
4500 KWH @ 0.0990									445.50 ✓		
10,000 KWH @ 0.0934									934.00 ✓		
67,630 KWH @ 0.0758									5,142.20 ✓		
COST OF POWER ADJUSTMENT								0.01933 PER/KWH	(1,601.26) ✓		
POWER WHEELED									15,183.03 ✓		
DEMAND								2544 KW @ \$6.25	15,900.00 ✓		
LATE CHARGE									15.00 ✓		
REGULATORY CHARGES @ 0.000386 CENTS/KWH									31.98 ✓		
TOTAL BILL									\$6,147.23 ✓		
THIS INVOICE DUE AND PAYABLE 30 DAYS FROM ABOVE DATE											

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$6,147.23

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$50,093.57

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$86,240.80

(see contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

FAIRBANKS, ALASKA

ACCOUNT NO: 010-4410-00

CONTRACT NUMBER: DAHC76-82-C-0009

NET AMOUNT DUE **\$127,569.00**

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GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

758 ILLINOIS STREET - BOX 71240

FAIRBANKS, ALASKA

SOLD TO: DIRECTORATE OF PUBLIC WORKS
1000 GAFFNEY BLVD. #6500
ATTN: APVR - FW - PW - 0
POWER PLANT
FT. WAINWRIGHT, AK 99703-8500

DATE August 4, 1994

ACCOUNT NO: 010-4410-00

REGARDING Ft. Greely In from GVEA

BILLING PERIOD JULY 1994

CONTRACT NUMBER: DAHC75-92-C-0000

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS.	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	NET TOTAL	TAX TOTAL
70978	2400	2191 ✓	1796 ✓		465			1,092,000			
	DEMAND				0.91 ✓			2,184			
70197	10	159,632 ✓	62,800 ✓		96,763		967,630				
	FWO > 120% OF FT. GREELY DEMAND						81,368 ✓	936,292			
	FWO - 11.1% = WE	103,925						832,337			
	FORT GREELY KWH RECEIVED							1,092,000			
	FORT WAINWRIGHT ADJUSTED OUTPUT							832,337			
	PURCHASED ELECTRICITY							259,663			
	POWER PURCHASE COSTS										
	CUSTOMER CHARGE							40.00			
	500 KWH @		0.1136					56.80			
	4500 KWH @		0.0090					445.50			
	10,000 KWH @		0.0634					634.00			
	244,863 KWH @		0.0758					18,545.46			
	COST OF POWER ADJUSTMENT		0.0197 ✓ PER/KWH					(5,117.96)			
	POWER WHEELED							11,182.07			
	DEMAND	2184 KW @ \$4.25						13,650.00			
	LATE CHARGE							15.00			
	REGULATORY CHARGES @	0.000386 CENTS/KWH						100.23			
	TOTAL BILL							\$9,851.11			
	THIS INVOICE DUE AND PAYABLE 25 DAYS FROM ABOVE DATE										

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$9,851.11

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$50,093.57

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$80,944.68

(See contract for penalty information)

CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
IF PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

750 ILLINOIS STREET - BOX 71249

FAIRBANKS, ALASKA

SOLD TO: Facilities Engineers
Utilities Engineers
P.O. Box 3016
Ft Greely AK 99703

DATE September 1, 1994

ACCOUNT NO: 010-4410-00

ACTUAL

(overcharge)

REGARDING Ft. Greely in from GVEA

BILLING PERIOD AUGUST 1994

CONTRACT NUMBER: DAHC76-92-C-0000

METER NO.	MULT.	PRES. READ	PREV. READ	BASE CONS.	TRUE CALC. CONS	DEM. READ	TRU CALC. DEMAND	DEMAND TOTAL	BILL TOTAL	SITE TOTAL	TAX TOTAL
70676	2400	2606	2191		475			1,140,000			
DEMAND								0.95	2,280		
70197	10	284,751	156,632		125,119		1,251,190				
FWO > 120% OF FT. GREELY DEMAND								68,863	1,182,327		
FWO - 11.1% = WE									1,051,089		
FORT GREELY KWH RECEIVED									1,140,000		
FORT WAINWRIGHT ADJUSTED OUTPUT									1,051,089		
PURCHASED ELECTRICITY									88,911		
POWER PURCHASE COSTS											
CUSTOMER CHARGE									40.00		
500 KWH @								0.1136	56.80		
4500 KWH @								0.0990	445.50		
10,000 KWH @								0.0934	934.00		
73,911 KWH @								0.0758	5,602.48		
COST OF POWER ADJUSTMENT								0.01971 PER/KWH	(1,752.44)		
POWER WHEELED									14,107.03		
DEMAND 2280 KW @ \$5.25									14,250.00		
LATE CHARGE									15.00		
REGULATORY CHARGES @ 0.000366 CENTS/KWH									84.82		
TOTAL BILL									33,732.68		

THIS INVOICE DUE AND PAYABLE 20 DAYS FROM ABOVE DATE

BILL AND DEMAND TOTAL \$

SURCHARGE OR DISCOUNT \$

CONNECTING CHARGE DETAIL \$

NET TOTAL \$33,732.68

PENALTY TOTAL \$

ADD TAX

ADD TAX \$

ARREARS \$89,944.67

PENALTY AMOUNT DUE \$

NET AMOUNT DUE \$123,677.35

(See contract for penalty information)

I CERTIFY THAT THE ABOVE BILL IS CORRECT AND JUST AND
THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED

GOLDEN VALLEY ELECTRIC ASSOCIATION, INC.

BY _____

GVEA Electric Rate Schedules

These rates have been in effect since October 1982.

Residential	Customer Charge	\$10.00
	Energy Charge	
	First 500 kwh	\$.1125/kwh
	Over 500 kwh	.095/kwh

GS-1 (General Service-1)	Customer Charge	\$20.00
	Energy Charge	
	First 500 kwh	\$.150/kwh
	Next 4,500 kwh	.111/kwh
	Over 5,000 kwh	.095/kwh

GS-2 (General Service-2)	Customer Charge	\$40.00
	Demand Charge	
	All kw	\$ 6.25/kw
	Energy Charge	
	First 500 kwh	\$.1136/kwh
	Next 4,500 kwh	.099/kwh
	Next 10,000 kwh	.0934/kwh
	Over 15,000 kwh	.0758/kwh

Effective Rates

(Includes fuel
adjustment reduction.)

\$.09208/kwh
\$.07458/kwh

\$.12958/kwh
\$.09058/kwh
\$.07458/kwh

~~\$.09118/kwh~~
~~\$.07858/kwh~~
~~\$.07298/kwh~~
~~\$.05538/kwh~~

How to Calculate Your Monthly Bill

This example shows how the total due was calculated for a sample residential bill for 874 kilowatt-hours.

Monthly customer charge	\$10.00
First 500 kwh x \$0.1125	56.25
Remaining 374 kwh x \$0.095	<u>35.53</u>
	\$101.78
Less fuel adjustment	
874 kwh x \$.02042*	(\$17.85)
Regulatory Cost Charge	
874 kwh x \$.000412**	<u>.36</u>
TOTAL DUE	\$84.29

*CPA effective 12/6/94 (calculated quarterly)

**RCC effective 11/1/94



**Golden Valley
Electric Association**

"Owned By Those We Serve."

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
 Suite C-200 Suite 220
 Denver, CO 80227 Roswell, GA 30075
 (303) 988-2951 (404) 642-1864

JOB FT. WAINWRIGHT FUEL STUDYSHEET NO. 1 OF 1CALCULATED BY PR DATE 11/24/97

CHECKED BY _____ DATE _____

SCALE _____

ESTIMATED ENERGY COST FOR FT. WAINWRIGHT

1. FROM FIELD OBSERVATIONS AT EXISTING T6-5, STRAIGHT CONDENSING,

$$\text{POWER OUTPUT} = 3200 \text{ KW}$$

$$\text{STEAM FLOW (AM)} = 40,000 \text{ LB/HR}$$

$$\text{THEN ACTUAL STEAM RATE} = \frac{40,000 \text{ LB/HR}}{3200 \text{ KW}} = 12.53 \frac{\text{LB}}{\text{HR KW}}$$

2. ENTHALPY OF STEAM AT 40 PSIG AND 165.0°F =
- $h = 1336 \text{ BTU/LB}$

ENERGY REQUIRED FOR PRODUCING STEAM RATE =

$$1336 \frac{\text{BTU}}{\text{LB}} (12.53 \frac{\text{LB}}{\text{HR KW}}) = 16,700 \frac{\text{BTU}}{\text{HR KW}}$$

3. HEATING VALUE OF COAL = 7800 BTU/LB (FROM PLANT PERSONNEL)

ASSUMING 80% BOILER EFFICIENCY; REQUIRED COAL =

$$\frac{16,700 \frac{\text{BTU}}{\text{HR KW}}}{(0.8)(7800 \text{ BTU/LB})} = 2.68 \frac{\text{LB}}{\text{KWH}}$$

4. COST OF COAL = \$45/TON (FROM PLANT PERSONNEL)

$$5. \text{COST PER KWH} = 2.68 \frac{\text{LB}}{\text{KWH}} \left(\frac{\$45}{2000 \text{ LB}} \right) = \$0.06/\text{KWH}$$

AGREES WITH GOVERNMENT PROVIDED RATES

ENERGY CONSERVATION PROJECT TYPES
(Recommended Economic Analysis Life)

<u>Category</u>	<u>Title</u>	<u>Description</u>
1.	EMCS or HVAC Controls (10 years)	Projects which centrally control energy systems with the ability to automatically adjust temperature, shed electrical loads, control motor speeds or adjust lighting intensities.
2.	Steam and Condensate Systems (15 years)	Projects to install condensate lines, cross connect lines, distribution system loops, repair or install insulation and steam flow meters and controls.
3.	Boiler Plant Modifications (20 years)	Projects to upgrade or replace central boilers or ancillary equipment to improve overall efficiency. This includes fuel switching of dual fuel conversions.
4.	Heating, Ventilating, Air-Conditioning (HVAC) (20 years)	Projects to install more energy efficient heating, cooling, ventilation or hot water heating equipment. This includes the HVAC distribution systems (ducts, pipes, etc).
5.	Weatherization (20 years)	Projects improving the thermal envelope of a building. This includes building insulation (wall, roof, foundation), insulated doors, windows, vestibules, earth berming, shading, etc).
6.	Lighting Systems (15 years)	Projects to install replacement lighting systems and controls. This would include daylighting, new fixtures, lamps, ballasts, photocells, motion sensors, IR sensors, light wells, highly reflective painting, etc.
7.	Energy Recovery Systems (20 years)	Projects to install heat exchangers, regenerators, heat reclaim units or recapture energy lost to the environment.
8.	Electrical Energy Systems (20 years)	Projects that will increase the energy efficiency of an electrical device or system or reduce cost by reducing peak demand.
9.	Renewable Energy Systems (20 years)	Any project utilizing renewable energy. This includes active solar heating, cooling, hot water, industrial process heat, photovoltaic, wind, biomass, geothermal, and passive solar applications.
10.	Facility Energy Improvements (20 years)	Multiple category projects or those that do not fall into any other category.

Table Ba-4. FEMP UPV* Discount Factors adjusted for fuel price escalation, by end-use sector and fuel type.^a
Discount Rate = 4.1 percent (DOE)

Census Region 4 (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming)

N	RESIDENTIAL			COMMERCIAL			INDUSTRIAL			TRANSPORT						
	ELEC	DIST	LPG	NTGAS	ELEC	DIST	RESID	NTGAS	COAL	ELEC	DIST	RESID	NTGAS	COAL	GASLN	N
1	0.96	1.00	0.98	0.95	0.96	1.02	0.99	0.95	0.97	0.95	1.02	0.99	0.95	0.98	1.01	1
2	1.88	2.00	1.94	1.85	1.88	2.05	1.97	1.85	1.89	1.87	2.04	1.97	1.85	1.91	2.01	2
3	2.77	2.98	2.89	2.72	2.77	3.08	2.93	2.72	2.76	2.76	3.05	2.95	2.73	2.80	3.00	3
4	3.64	3.94	3.81	3.56	3.64	4.08	3.88	3.56	3.61	3.62	4.04	3.91	3.58	3.66	3.96	4
5	4.47	4.86	4.70	4.37	4.48	5.06	4.82	4.38	4.43	4.45	5.00	4.86	4.43	4.48	4.89	5
6	5.28	5.77	5.57	5.18	5.30	6.02	5.75	5.20	5.22	5.26	5.95	5.80	5.29	5.29	5.78	6
7	6.08	6.65	6.40	5.98	6.11	6.96	6.65	6.02	5.98	6.06	6.88	6.72	6.19	6.06	6.65	7
8	6.85	7.51	7.22	6.79	6.91	7.88	7.54	6.85	6.71	6.84	7.78	7.63	7.11	6.81	7.49	8
9	7.61	8.35	8.03	7.59	7.68	8.79	8.42	7.69	7.42	7.59	8.67	8.52	8.06	7.53	8.30	9
10	8.33	9.16	8.82	8.38	8.42	9.67	9.27	8.51	8.10	8.32	9.53	9.39	9.01	8.22	9.08	10
11	9.04	9.95	9.59	9.15	9.15	10.52	10.11	9.32	8.76	9.03	10.37	10.24	9.96	8.89	9.83	11
12	9.73	10.72	10.35	9.91	9.86	11.36	10.92	10.11	9.39	9.72	11.19	11.08	10.91	9.53	10.55	12
13	10.40	11.46	11.08	10.64	10.55	12.18	11.73	10.88	10.01	10.39	11.98	11.90	11.82	10.15	11.25	13
14	11.05	12.19	11.79	11.33	11.23	12.98	12.52	11.60	10.60	11.04	12.76	12.72	12.69	10.77	11.92	14
15	11.67	12.90	12.49	11.99	11.88	13.76	13.29	12.30	11.17	11.67	13.53	13.51	13.53	11.36	12.57	15
16	12.28	13.59	13.16	12.63	12.51	14.52	14.05	12.97	11.73	12.27	14.26	14.29	14.34	11.93	13.20	16
17	12.86	14.25	13.81	13.25	13.11	15.26	14.79	13.62	12.26	12.85	14.98	15.05	15.12	12.49	13.80	17
18	13.42	14.89	14.44	13.85	13.70	15.98	15.51	14.25	12.78	13.41	15.68	15.79	15.88	13.02	14.39	18
19	13.97	15.52	15.05	14.42	14.27	16.67	16.21	14.85	13.28	13.95	16.35	16.52	16.61	13.54	14.95	19
20	14.49	16.12	15.64	14.98	14.82	17.35	16.90	15.44	13.75	14.47	17.01	17.23	17.32	14.04	15.50	20
21	15.00	16.70	16.20	15.51	15.35	18.01	17.57	16.00	14.22	14.97	17.65	17.92	18.01	14.52	16.02	21
22	15.49	17.27	16.75	16.03	15.86	18.65	18.22	16.55	14.66	15.45	18.26	18.59	18.68	14.99	16.53	22
23	15.97	17.82	17.28	16.53	16.35	19.26	18.86	17.08	15.09	15.92	18.86	19.25	19.32	15.44	17.03	23
24	16.43	18.35	17.79	17.01	16.83	19.86	19.48	17.59	15.50	16.37	19.44	19.89	19.94	15.88	17.50	24
25	16.87	18.86	18.28	17.48	17.29	20.44	20.08	18.08	15.90	16.80	20.00	20.52	20.54	16.30	17.96	25
26/a	17.30	19.35	18.75	17.93	17.74	21.00	20.66	18.56	16.29	17.21	20.55	21.12	21.13	16.70	18.40	26
27/a	17.71	19.83	19.21	18.36	18.17	21.55	21.23	19.02	16.66	17.61	21.07	21.71	21.69	17.09	18.83	27
28/a	18.12	20.29	19.65	18.78	18.59	22.07	21.78	19.46	17.01	18.00	21.58	22.28	22.24	17.47	19.24	28
29/a	18.50	20.74	20.07	19.19	18.99	22.58	22.31	19.89	17.36	18.37	22.07	22.84	22.77	17.84	19.64	29
30/a	18.88	21.17	20.48	19.58	19.38	23.07	22.83	20.31	17.69	18.72	22.55	23.37	23.28	18.19	20.02	30

^a UPV* factors are reported for years 26-30 to accommodate a planning/construction period of up to 5 years. (See p. 6 for instructions on use.)

Estimated Energy Savings

1995 - 1997 Study

Load Factor - The load factor is defined as the ratio of the total kilowatt-hours measured to the peak kilowatts measured times the hours in the measurement period. For the purpose of this study the daily load factor is calculated for the day on which the peak load for the base occurred during each month for the months July 1994 through July 1995.

The load factor is calculated by summing the hourly kilowatt readings on the day of each month when the monthly peak occurred and dividing the sum by the daily peak kilowatt measurement times twenty-four hours. All values used are taken from the electric power plant operating log under the column heading "TOTAL GEN". This column is read off the plant totalizer meter by operating personnel every hour and provides the most accurate data for calculation of the load factor. The attached sheets show a plot of the daily load for each day used in the study.

Date	Daily Load Factor	Date	Daily Load Factor
5-Jul-95	77.4%	7-Dec-94	82.2%
23-Jun-95	77.1%	30-Nov-94	81.3%
16-May-95	77.7%	27-Oct-94	81.5%
5-Apr-95	78.6%	14-Sep-94	77.9%
14-Mar-95	81.8%	29-Aug-94	79.3%
23-Feb-95	82.8%	21-Jul-94	75.8%
27-Jan-95	80.8%		

The average daily load factor as defined for this study is the average of the sample daily load factors.

Average Load Factor = 79.6%

The average load factor is applied to the calculated line losses to approximate the daily average:

Study Title	Total Peak Line Losses	Average Line Losses
Case 1 Load Flow Study - Existing 2400 volt ungrounded delta system	76.1 KW	60.5 KW
Case 2 Load Flow Study - New 4160 volt grounded wye system	44.2 KW	35.2 KW

(Refer to appendix B for line loss calculations)

The KW savings is computed by subtracting the average losses of Case 2 from the average losses of Case 1:

KW Savings: 25.4 KW

The annual energy savings is the KW savings times the hours per year

KWH savings per year: 222329.7 KWH

1. COMPONENT	MILITARY CONSTRUCTION PROJECT DATA	2. DATE
	ARMY	Dec-95
3. INSTALLATION AND LOCATION		
Fort Greely, Alaska		
4. PROJECT TITLE	Limited Energy Study, Power Distribution 1995 to 1997 Study	5. PROJECT NUMBER
		DACA01-94-D-0033
LIFE CYCLE COST ANALYSIS SUMMARY		
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)		
LOCATION:	Fort Greely, Alaska	REGION: 4
PROJECT TITLE:	ECIP: Limited Energy Study, Power Distribution	PROJECT NO: 1406.003
DISCRETE PORTION NAME:	TOTAL	FISCAL YEAR: 1995
ANALYSIS DATE:	01/10/96	ECONOMIC LIFE: 20
		PREPARED BY: D Morris
1. INVESTMENT		
A.	CONSTRUCTION COST	\$994,468
B.	SIQH COST (5.5% of 1A) =	\$54,696
C.	DESIGN COST (6.0% of 1A) =	\$59,668
D.	TOTAL COST (1A + 1B + 1C) =	\$1,108,832
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =	
F.	PUBLIC UTILITY COMPANY REBATE =	
G.	TOTAL INVESTMENT (1D - 1E - 1F) =	----- > \$1,108,832
2. ENERGY SAVINGS (+) OR COST (-):		
DATE OF NISTIR 85-3273-10 USED FOR DISCOUNT FACTORS: OCT '95		
	ENERGY SOURCE	FUEL COST \$/kWh (1)
		SAVINGS kWh (2)
		ANNUAL \$ SAVINGS (3)
		DISCOUNT FACTOR (4)
		DISCOUNTED SAVINGS (5)
A.	ELECTRICITY	\$0.0832
B.	DIST	
C.	NAT GAS	
D.	REFUS	
E.	COAL	
F.	OTHER	
G.	OTHER	
H.	TOTAL	
		222,330
		\$18,498
		14.47
		\$267,664
		----- > \$267,664
3. NON-ENERGY SAVINGS (+) OR COST (-)		
A.	ANNUAL RECURRING (+/-)	
	1 DISCOUNT FACTOR	(From Table A) =
	2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =
B.	NON-RECURRING (+/-)	
	ITEM	SAVINGS (+) COST (-) (1)
		YEAR OF OCCURRENCE (2)
		DISCOUNT FACTOR (3)
		DISCOUNTED SAVINGS/COST (4) (TABLE B)
a.		
b.		
c.		
d.	TOTAL	
C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	
		(3A2 + 3Bd4) =
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3 + 3A + (3Bd1/Economic Life)) \$18,498
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) = 59.94
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) = \$267,664
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) = 0.24
	(MUST HAVE SIR > 1.25 TO QUALIFY)	

Energy

Estimated Energy Savings Post 2001 Study

Load Factor - The load factor is defined as the ratio of the total kilowatt-hours measured to the peak kilowatts measured times the hours in the measurement period. For the purpose of this study the daily load factor is calculated for the day on which the peak load for the base occurred during each month for the months July 1994 through July 1995.

The load factor is calculated by summing the hourly kilowatt readings on the day of each month when the monthly peak occurred and dividing the sum by the daily peak kilowatt measurement times twenty-four hours. All values used are taken from the electric power plant operating log under the column heading "TOTAL GEN". This column is read off the plant totalizer meter by operating personnel every hour and provides the most accurate data for calculation of the load factor. The attached sheets show a plot of the daily load for each day used in the study.

Date	Daily Load Factor	Date	Daily Load Factor
5-Jul-95	77.4%	7-Dec-94	82.2%
23-Jun-95	77.1%	30-Nov-94	81.3%
16-May-95	77.7%	27-Oct-94	81.5%
5-Apr-95	78.6%	14-Sep-94	77.9%
14-Mar-95	81.8%	29-Aug-94	79.3%
23-Feb-95	82.8%	21-Jul-94	75.8%
27-Jan-95	80.8%		

The average daily load factor as defined for this study is the average of the sample daily load factors.

Average Load Factor = 79.6%

The average load factor is applied to the calculated line losses to approximate the daily average:

	Total Peak Line Losses	Average Line Losses
Study Title		
Case 3 Load Flow Study - Existing 2400 volt ungrounded delta system	13.6 KW	10.8 KW
Case 4 Load Flow Study - New 4160 volt grounded wye system	11.2 KW	8.9 KW

(Refer to appendix B for line loss calculations)

The KW savings is computed by subtracting the average losses of Case 4 from the average losses of Case 3:

KW Savings: 1.9 KW

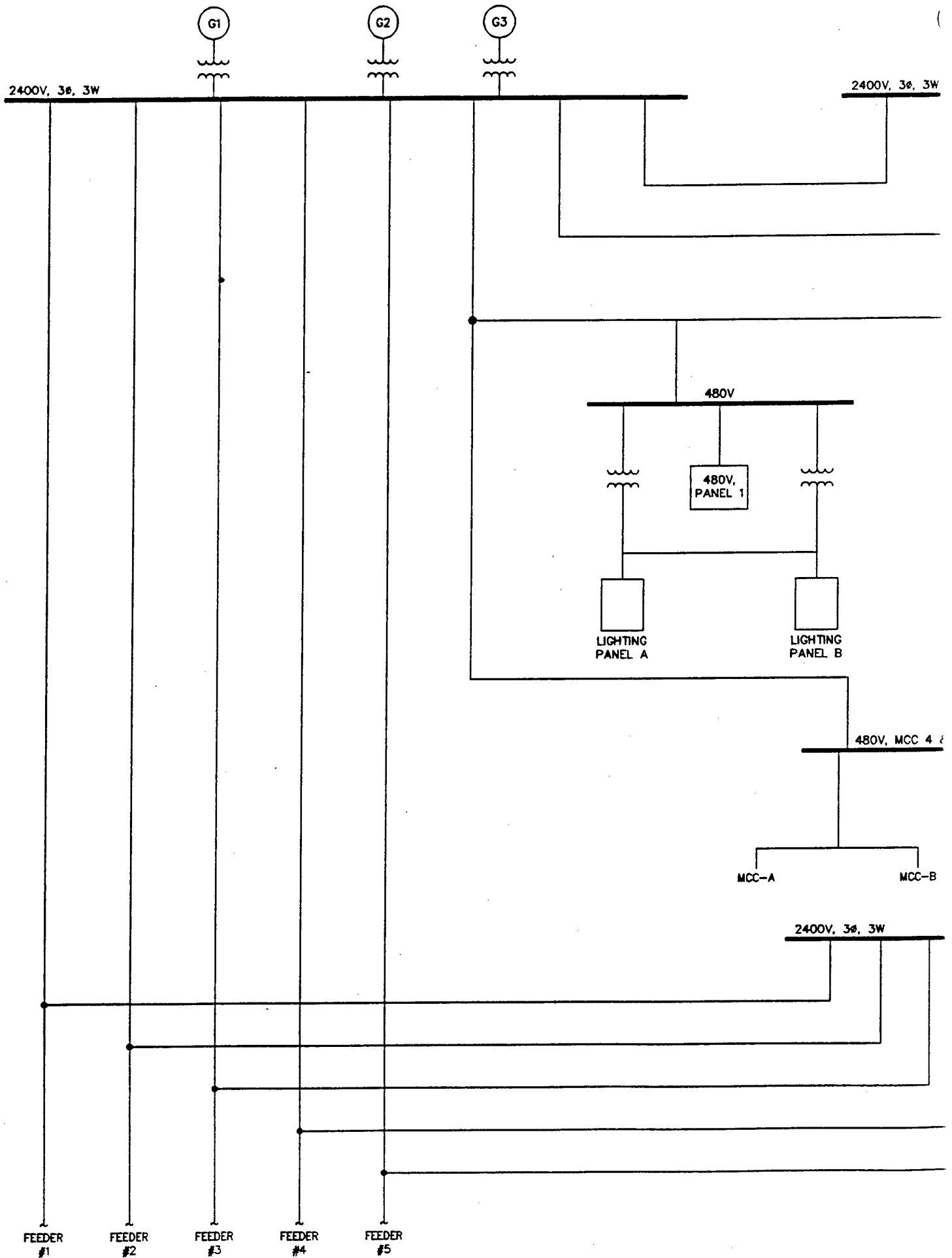
The annual energy savings is the KW savings times the hours per year

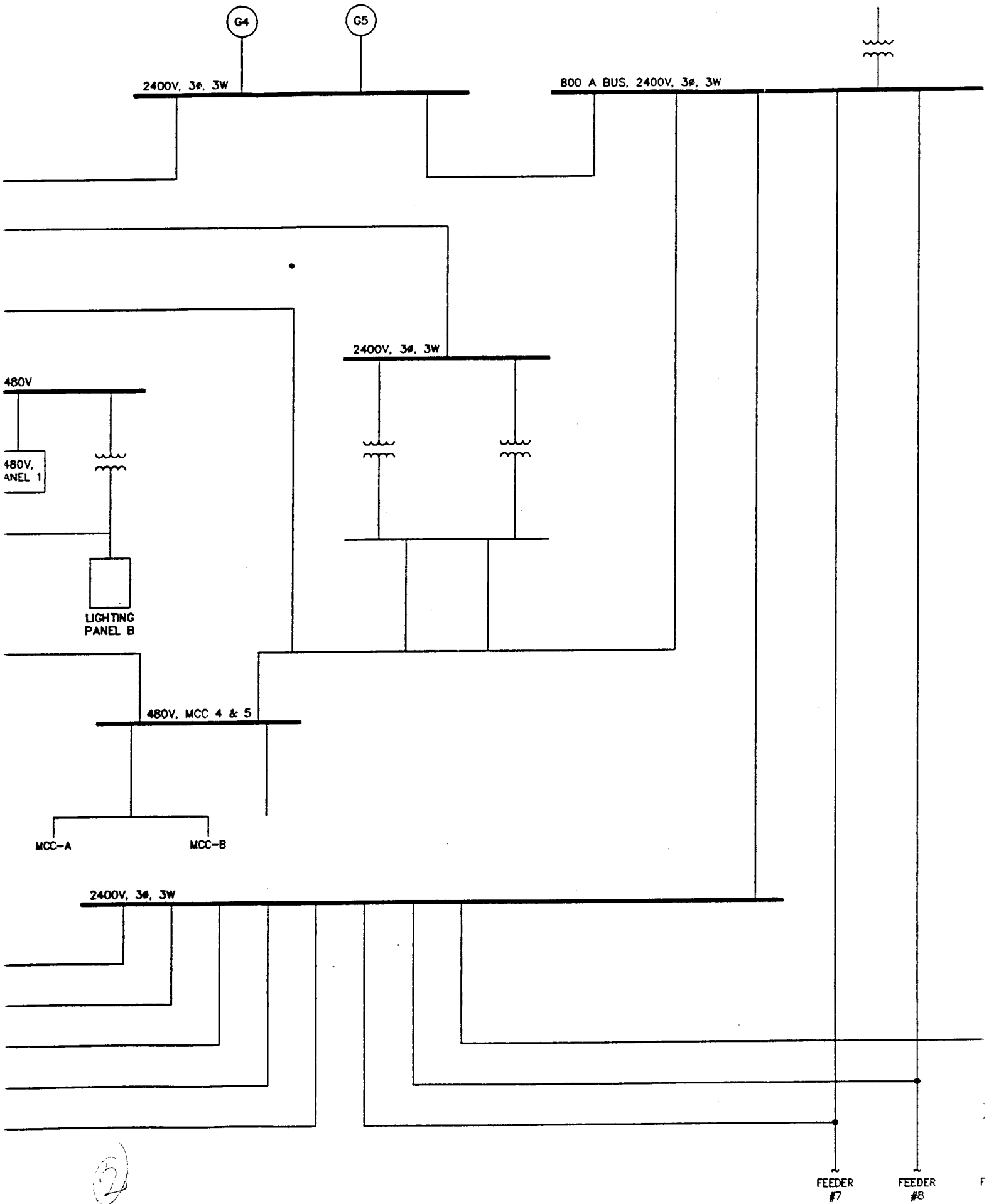
KWH savings per year: 16727.0 KWH

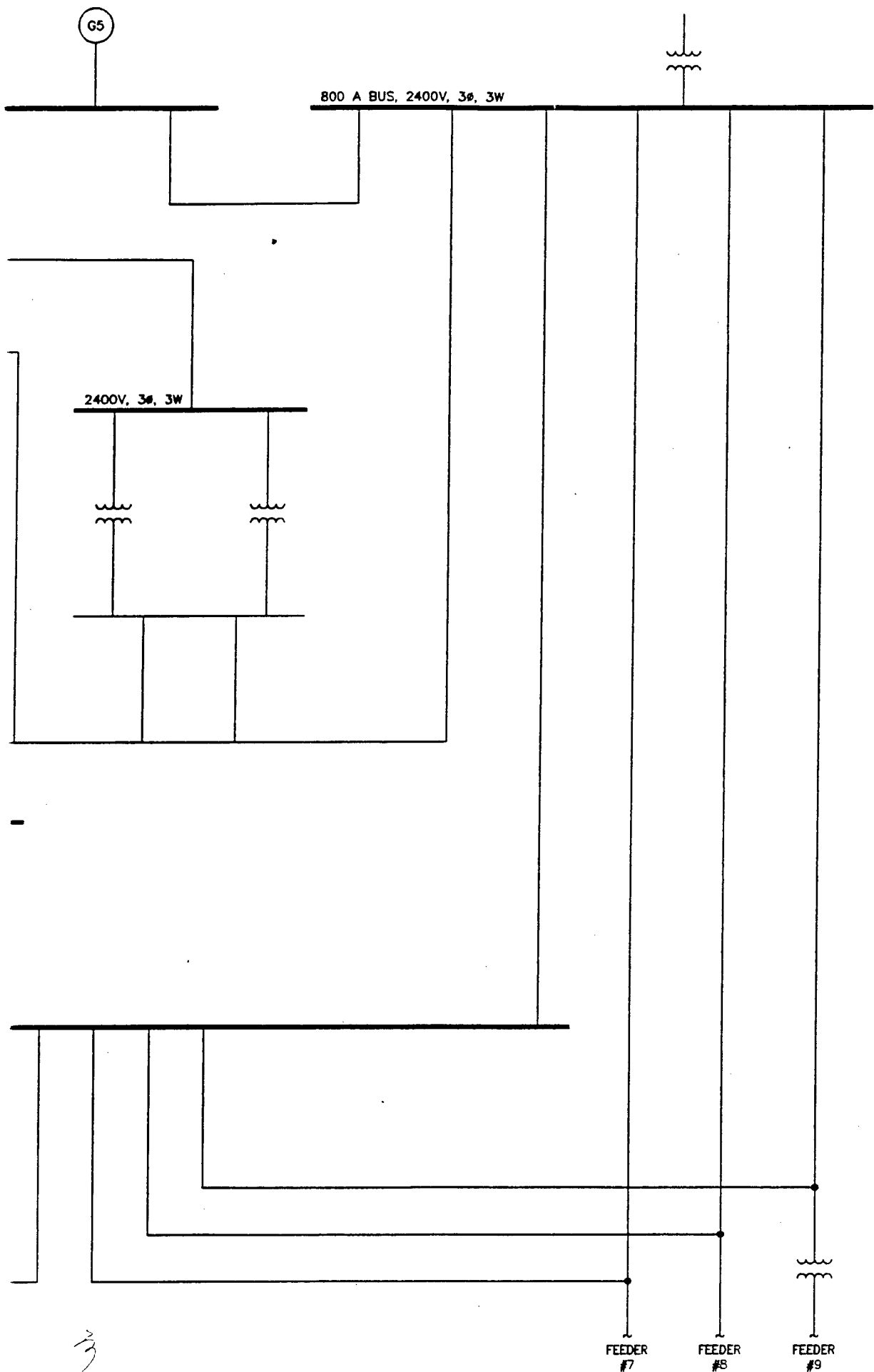
1. COMPONENT	MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		Dec-95
3. INSTALLATION AND LOCATION		
Fort Greely, Alaska		
4. PROJECT TITLE	Limited Energy Study, Power Distribution Post 2001 Study	5. PROJECT NUMBER
DACA01-94-D-0033		
LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)		
LOCATION:	Fort Greely, Alaska	REGION: 4
PROJECT TITLE:	ECIP: Limited Energy Study, Power Distribution	PROJECT NO: 1406.003
DISCRETE PORTION NAME:	TOTAL	FISCAL YEAR: 1995
ANALYSIS DATE:	01/10/96	ECONOMIC LIFE: 20
		PREPARED BY: D Morris
1. INVESTMENT		
A.	CONSTRUCTION COST	= = \$714,073
B.	SIOH COST	(5.5% of 1A) = \$39,274
C.	DESIGN COST	(6.0% of 1A) = \$42,844
D.	TOTAL COST	(1A + 1B + 1C) = \$796,191
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=
F.	PUBLIC UTILITY COMPANY REBATE	=
G.	TOTAL INVESTMENT	(1D - 1E - 1F) = -----> \$796,191
2. ENERGY SAVINGS (+) OR COST (-):		
DATE OF NISTIR 85-3273-10 USED FOR DISCOUNT FACTORS: OCT '95		
	ENERGY SOURCE	FUEL COST \$/kWh (1)
		SAVINGS kWh (2)
		ANNUAL \$ SAVINGS (3)
		DISCOUNT FACTOR (4)
		ISCOUNTED SAVINGS (5)
A.	ELECTRICITY	\$0.0832
		16,727
		\$1,392
		14.47
		\$20,138
B.	DIST	
C.	NAT GAS	
D.	REFUS	
E.	COAL	
F.	OTHER	
G.	OTHER	
H.	TOTAL	16,727
		\$1,392
		-----> \$20,138
3. NON-ENERGY SAVINGS (+) OR COST (-)		
A.	ANNUAL RECURRING (+/-)	
	1 DISCOUNT FACTOR	(From Table A) =
	2 DISCOUNTED SAVINGS (+) / COST (-)	(3A x 3A1) =
B.	NON-RECURRING (+/-)	
	ITEM	SAVINGS (+) COST(-) (1)
		YEAR OF OCCURRENCE (2)
		DISCOUNT FACTOR (3)
		DISCOUNTED SAVINGS/COST (4) (TABLE B)
a.		
b.		
c.		
d.	TOTAL	
C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	
		(3A2 + 3Bd4) =
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3 + 3A + (3Bd1/Economic Life))
		\$1,392
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =
		572.11
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) =
		\$20,138
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR)	(6/1G) =
		0.03
	(MUST HAVE SIR > 1.25 TO QUALIFY)	

APPENDIX L

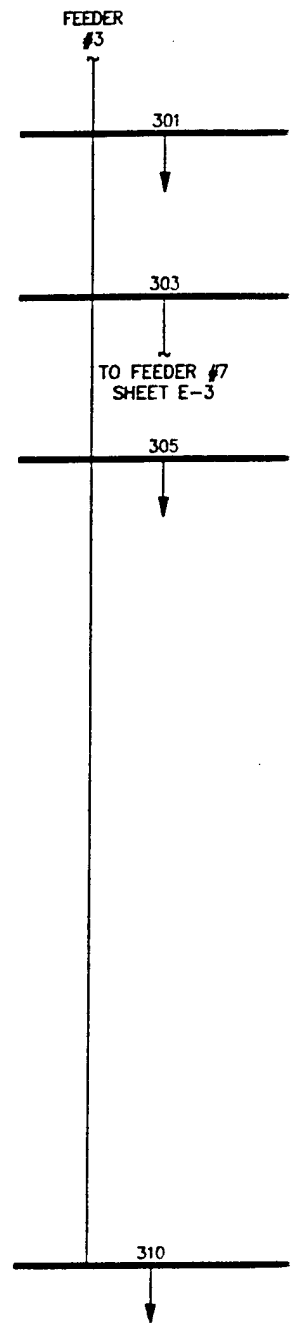
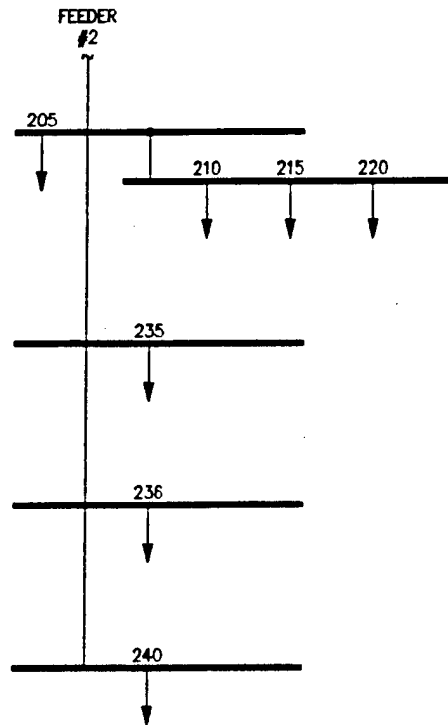
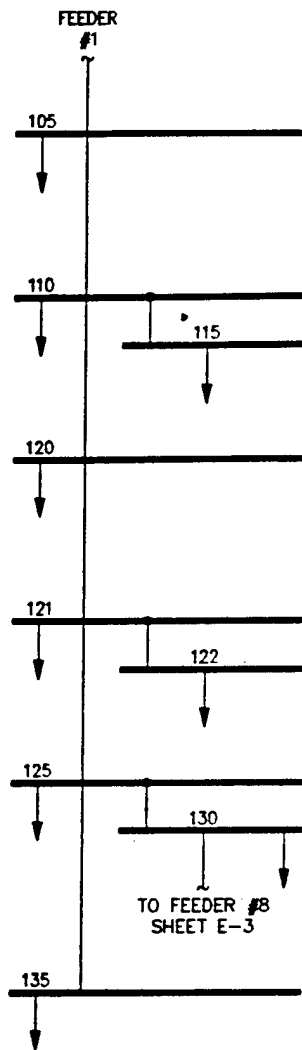
One-Line Diagrams

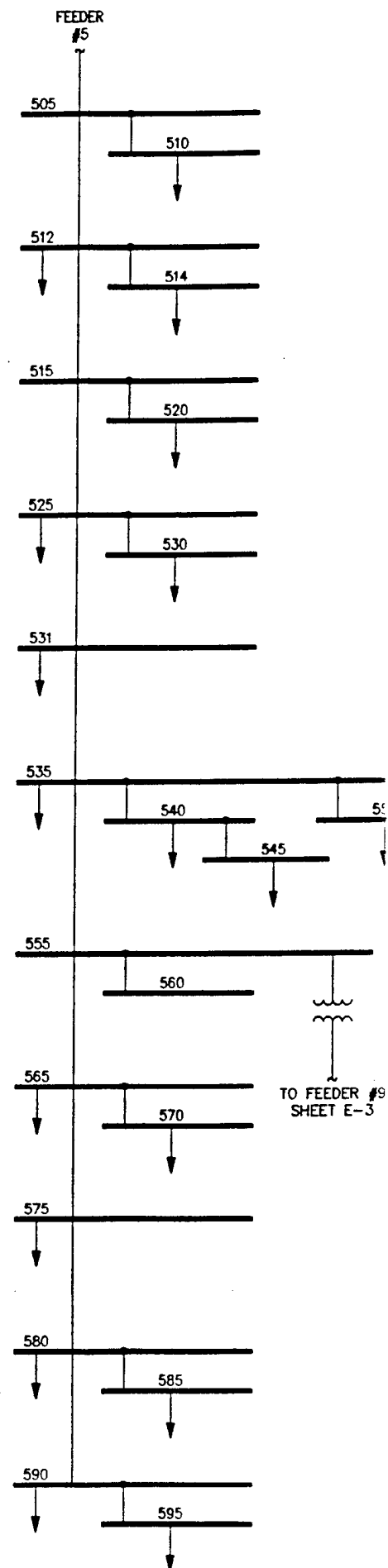
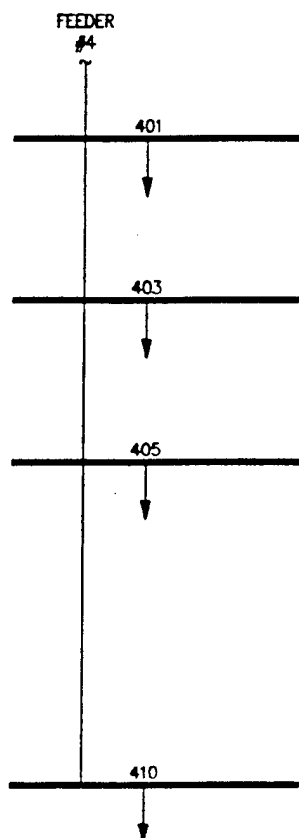
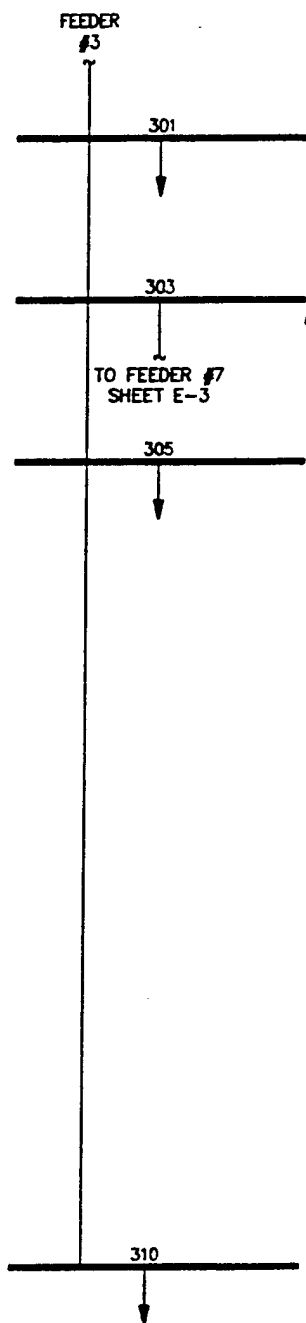






		PROJECT NO. 1408003		SHEET 1 OF 3	
		CONTRACT NO.		E-1	
		DIRECTORATE OF PUBLIC WORKS AN INDIAN DIVISION (DOWT) FORT RICHMOND, ALASKA 99501-1500		PROJECT TITLE ONE-LINE DIAGRAM 1995 - 1997 STUDY	
		INSTALLATION FT. O'REILLY, ALASKA		DRAWING NO. 1111	

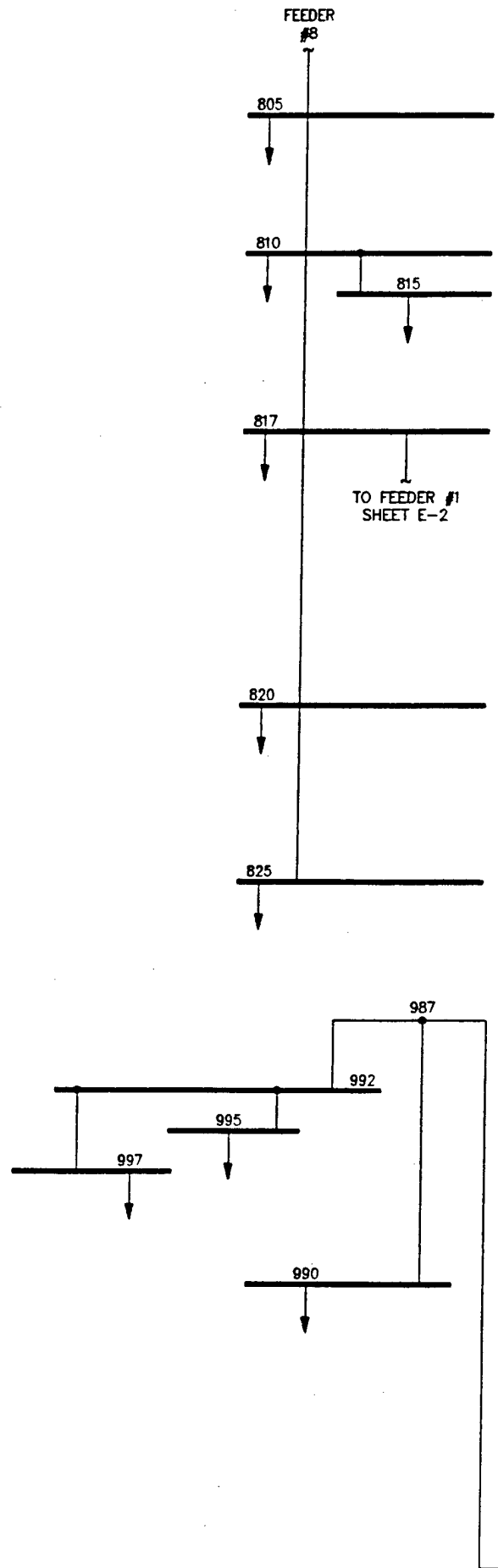
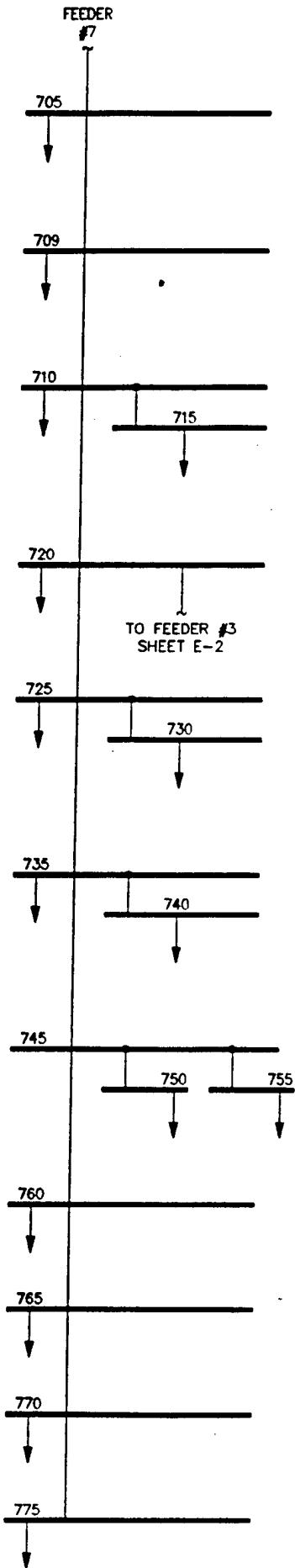


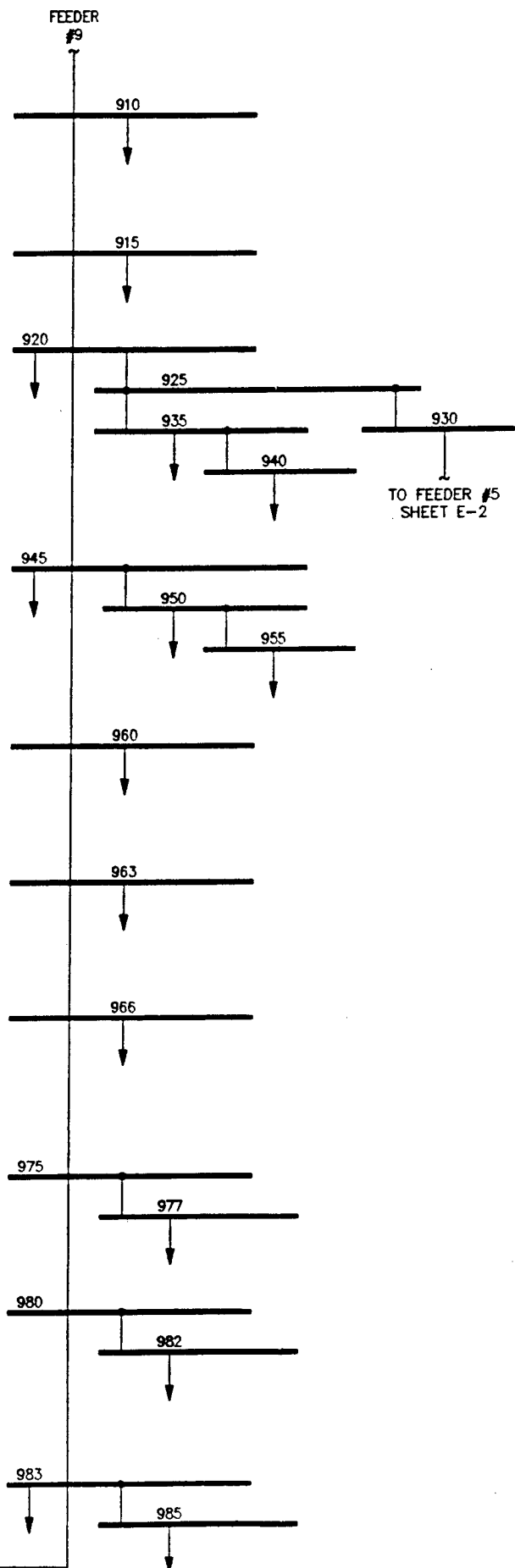
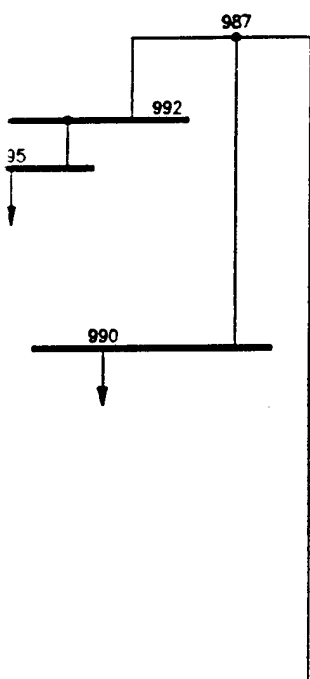
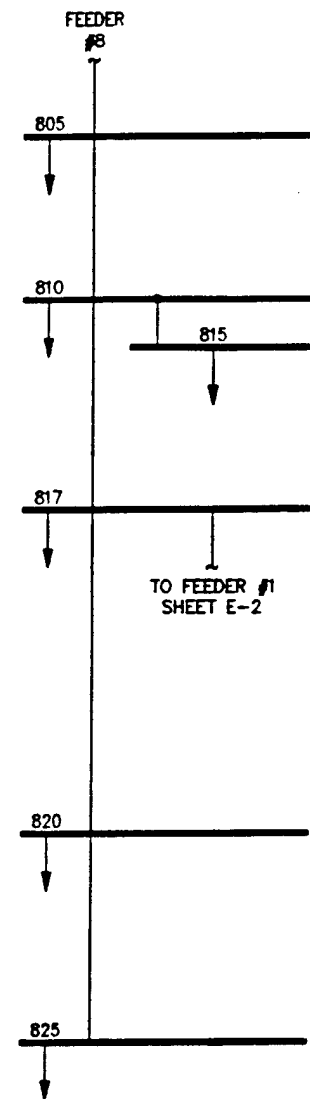


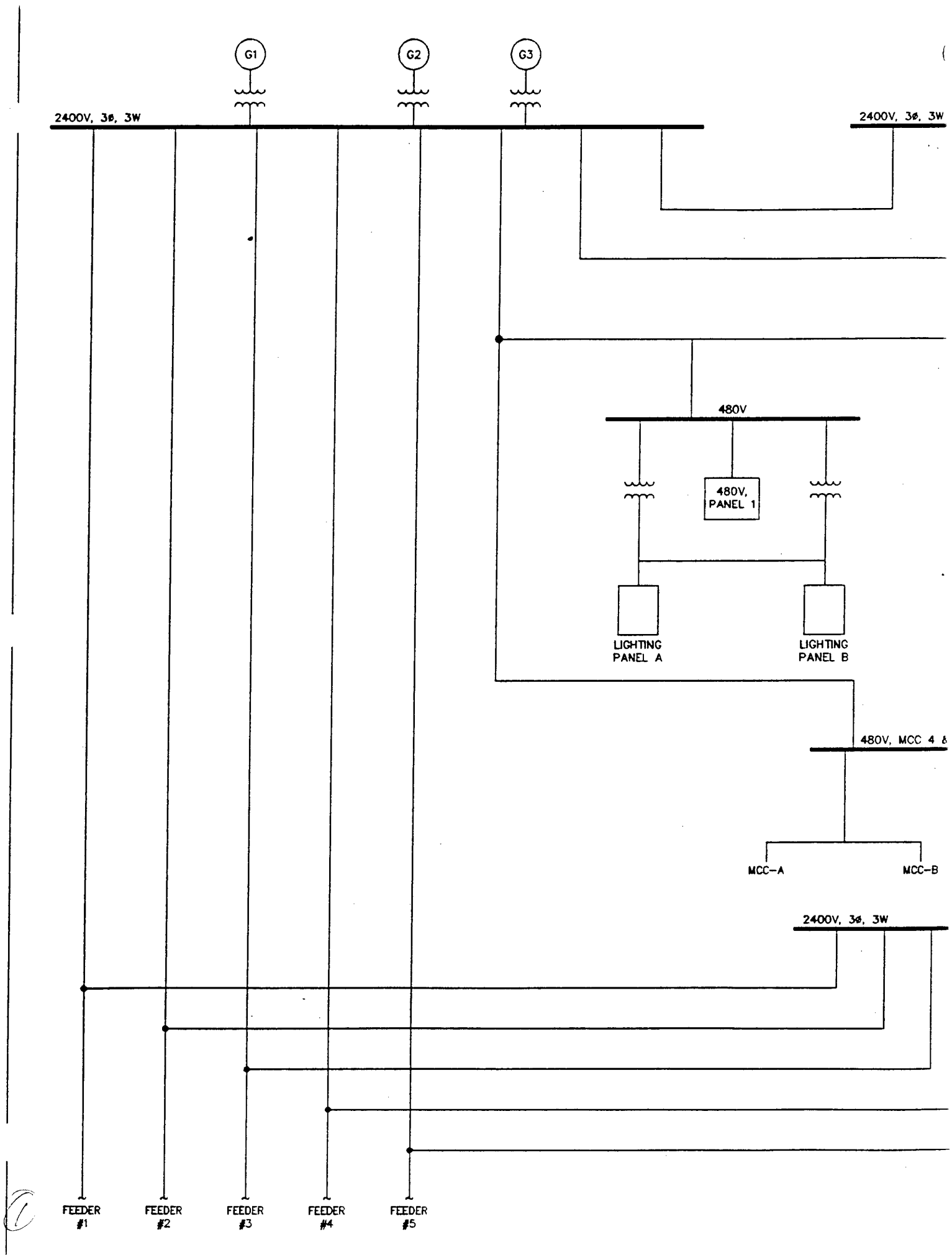
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E-2

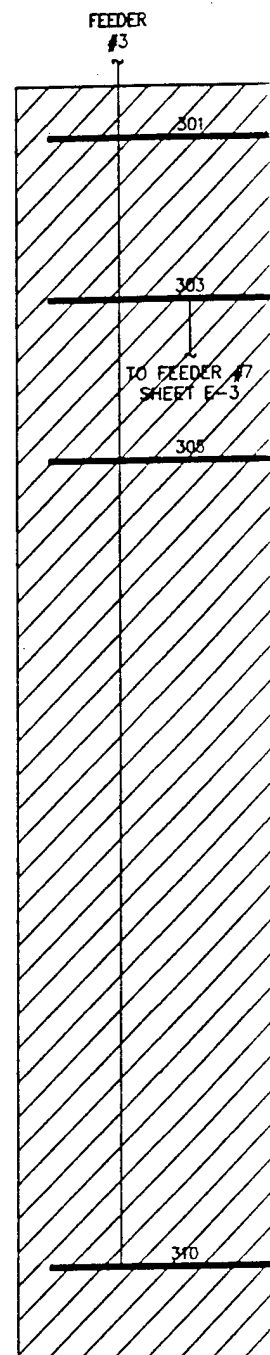
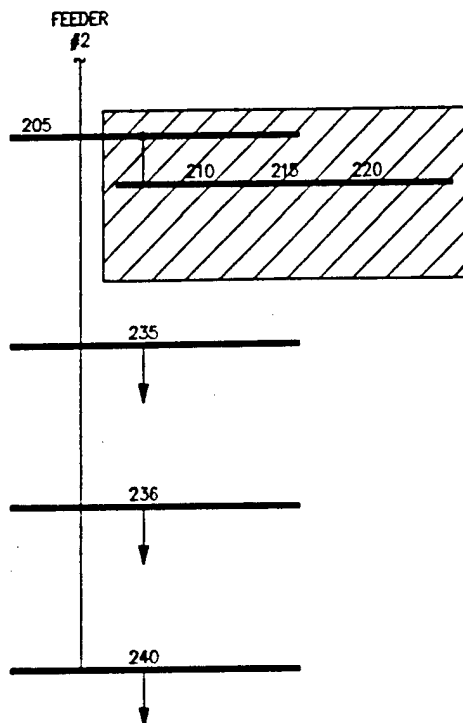
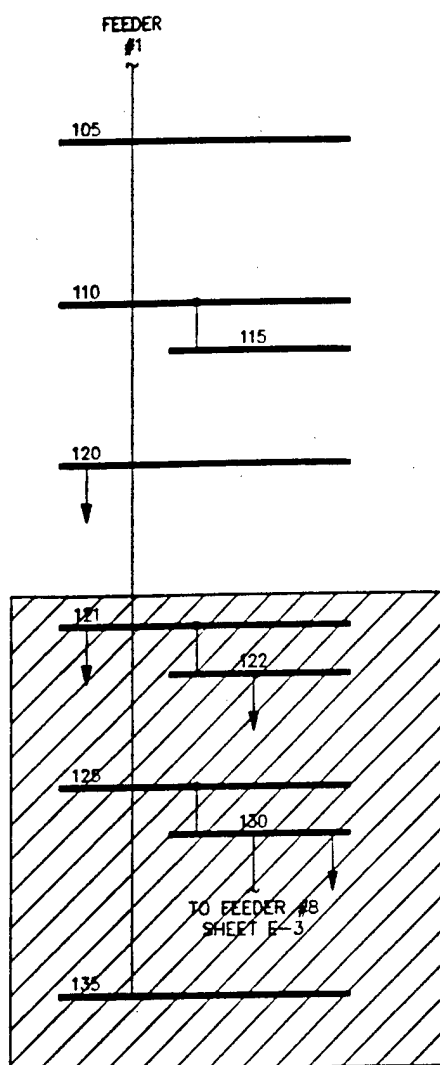




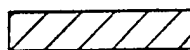




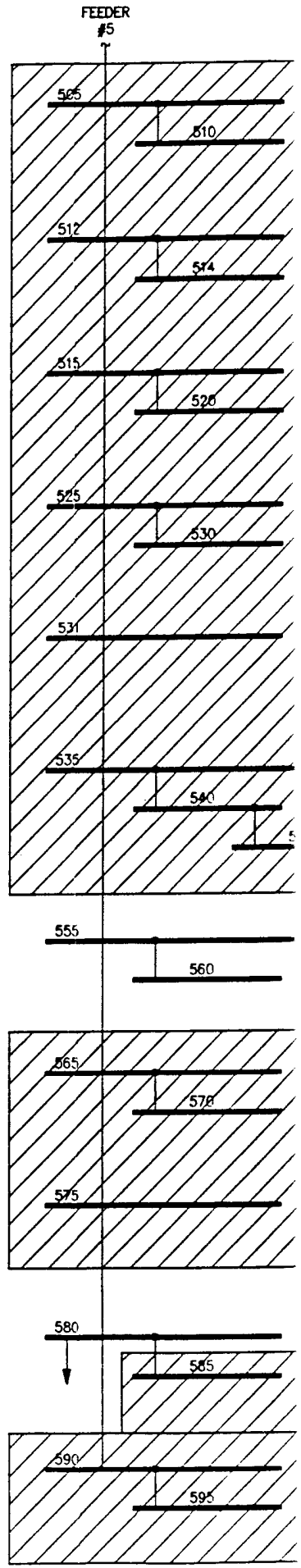
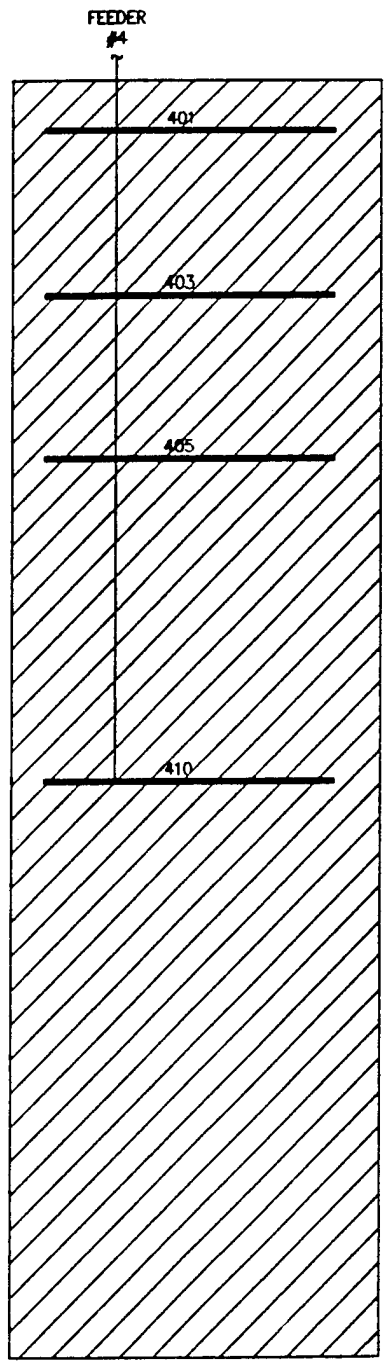
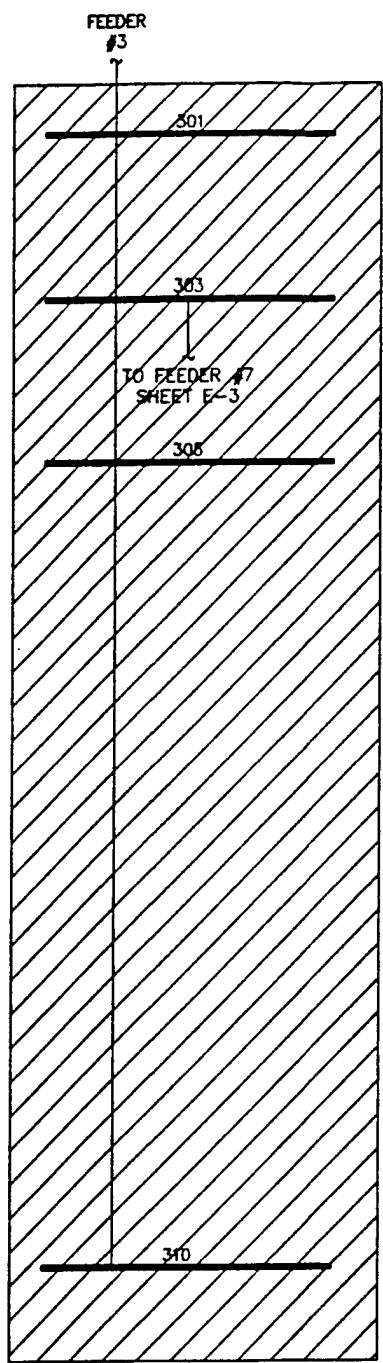
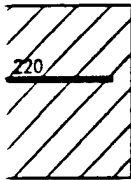
E-1



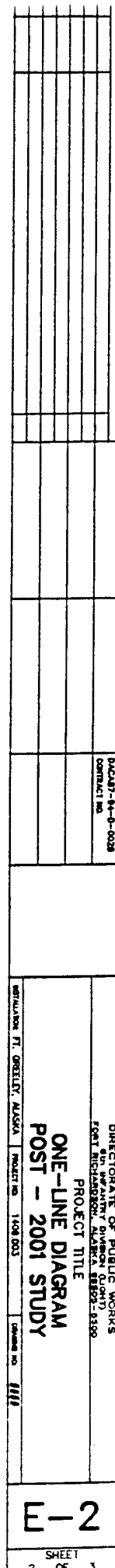
LEGEND

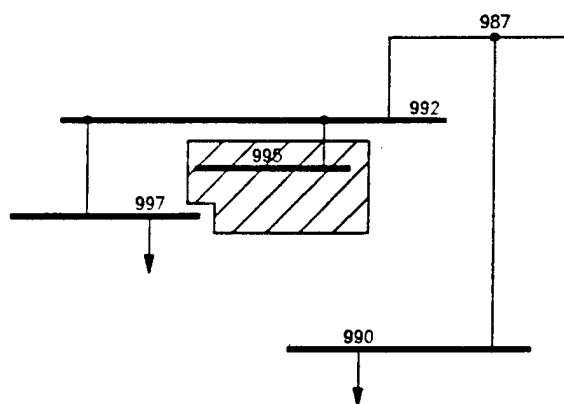
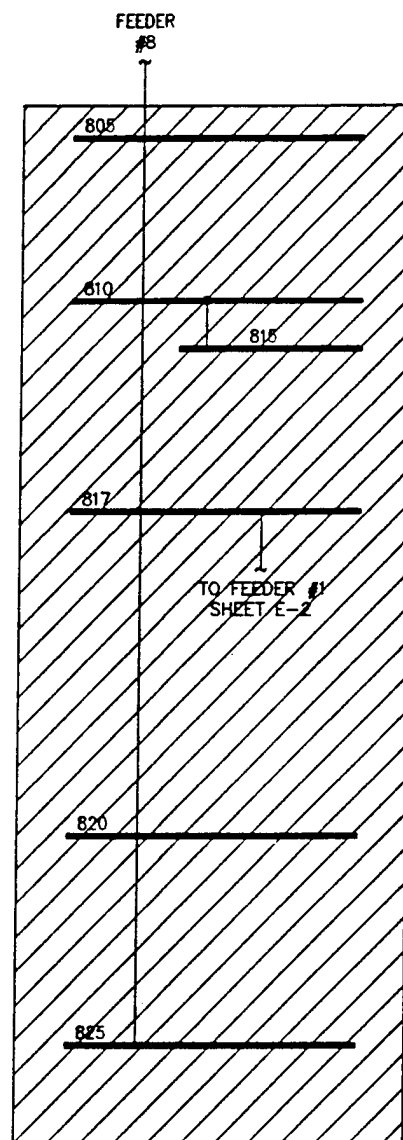
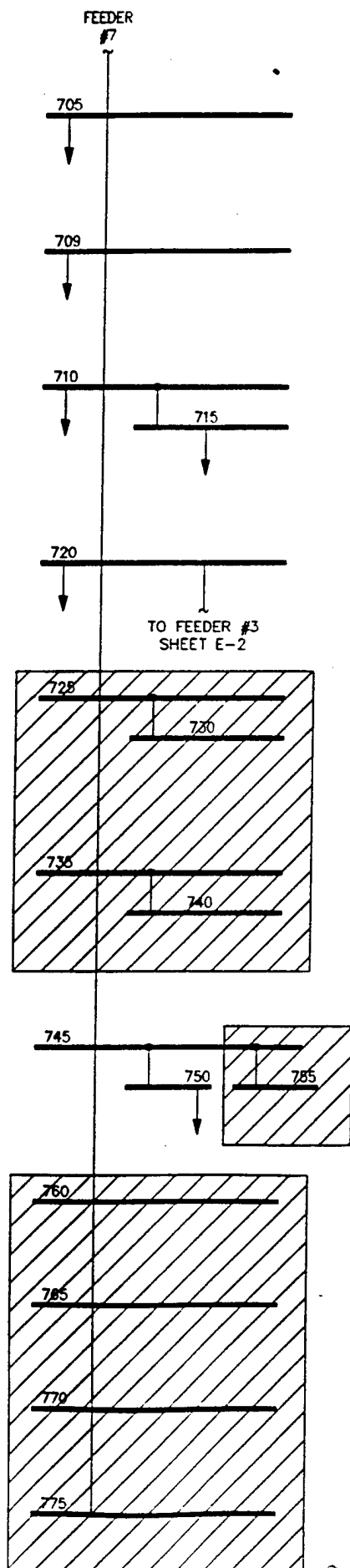


OUT OF SERVICE

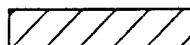


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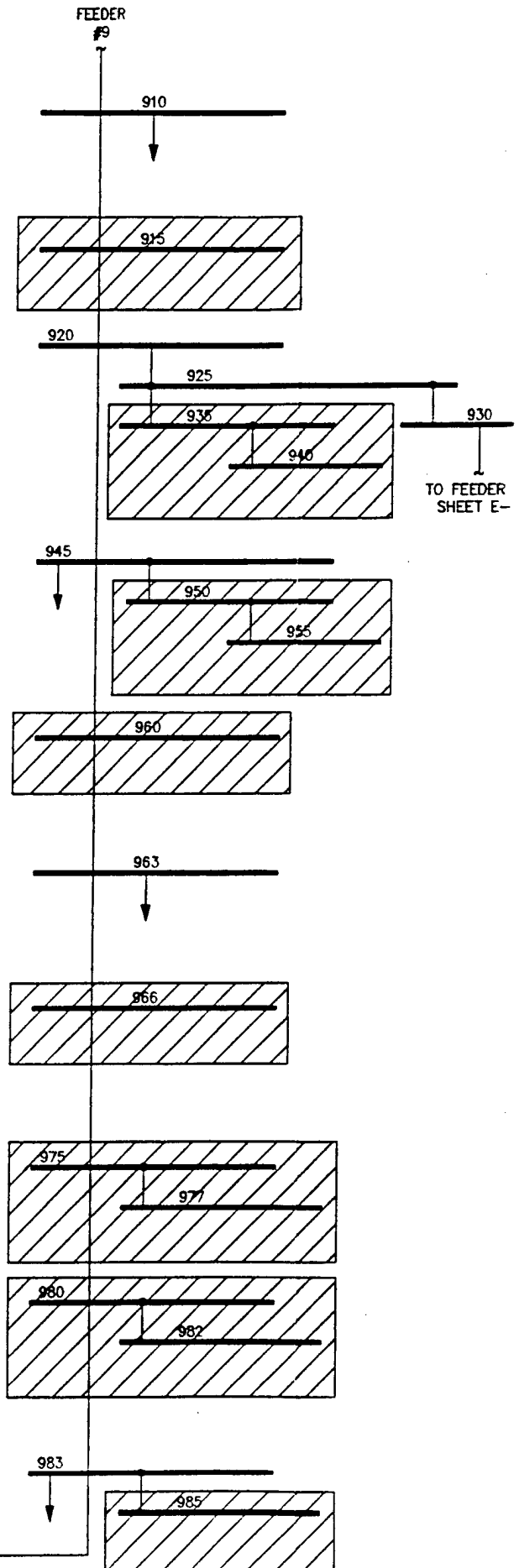
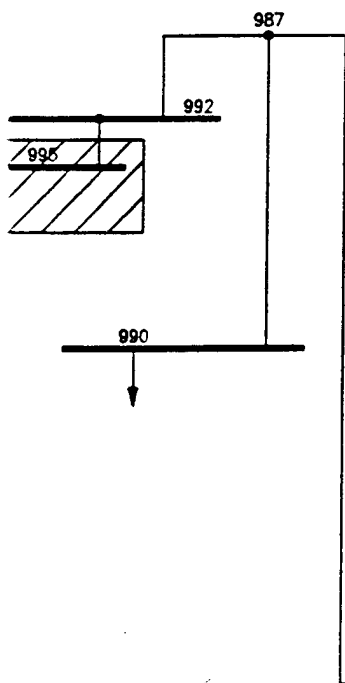
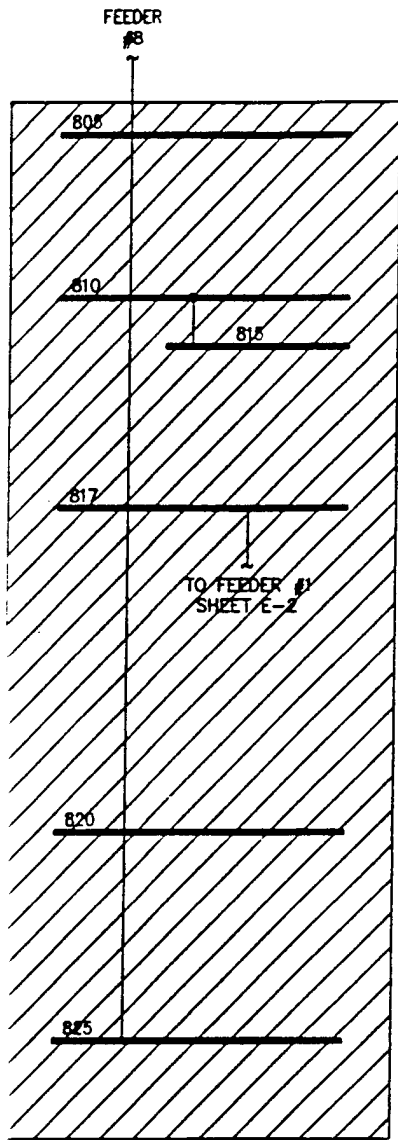




LEGEND



OUT OF SERVICE



2

